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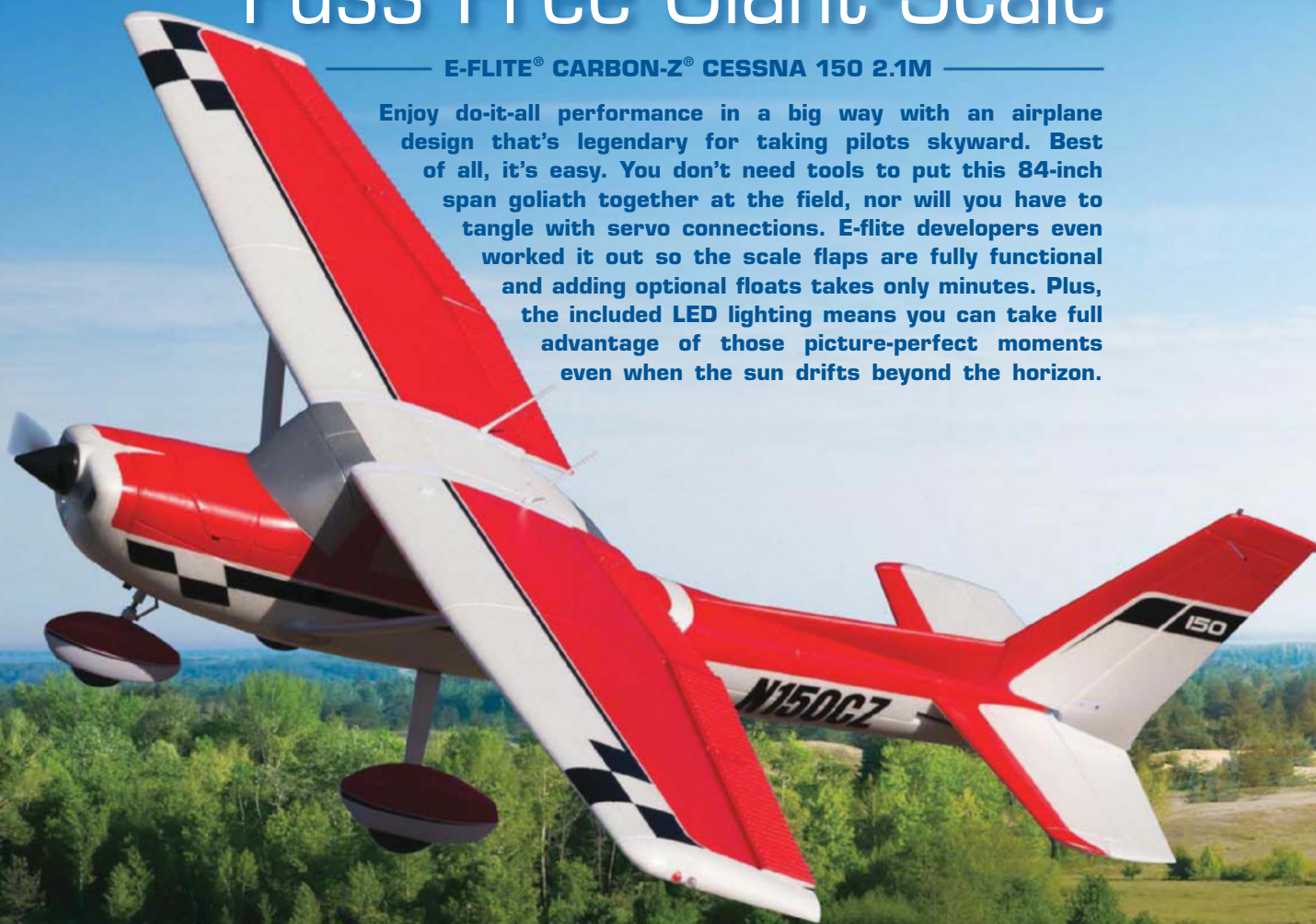
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ON THE COVER: Our annual Gear Guide in this issue is packed with terrific planes and products to get your summer-flying season off to a great start!

THIS PAGE: "The Lafayette Escadrille" shares how this film documentary is using giant-scale RC models in its flight sequences. (Photo by Mark Wilkins)





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Preflight

BY DEBRA CLEGHORN | EXECUTIVE EDITOR



Gearing Up for Summer

You'll be ready for summer-flying fun with the Gear Guide included in this issue! The highly anticipated Gear Guide has photos and information on more than 80 terrific planes, drones, radios, and accessories. From World War II warbirds to park-flier electrics, you'll find everything you could want, along with the support equipment you need to stay airborne. (Tip: Circle the items on your wish list and keep the Guide in a conspicuous place the rest of the year and you might be pleasantly surprised by this year's Father's Day, birthday, and holiday gifts!)

In This Issue

Like the hobby itself, this issue has some flying techniques, workshop tips, and a few unexpected treats we hope you'll enjoy. To start, David Scott's feature, "Good Habits Applied," is a must-read for pilots of all skill levels; whether you're just learning to solo or fly pattern competition, his insightful flight techniques are guaranteed to make you a better pilot. In "How to Balance Propellers," you'll learn why this step is so important and how to do it properly, and in "DIY Racer," you'll see just how easy it can be to build an FPV drone from the ground up. Engine Clinic columnist Clarence Lee always has something interesting to share about getting engines to run properly, and Let's Talk Giant Scale

columnist John Glezellis details how to choose and install power systems in big aircraft. In the "something different" category, how many of you—like me—know what Aresti diagrams are but aren't sure of how to read them? "The Language of Aerobatics" delves into the history of this unique international vocabulary and shares an overview on how to read the diagrams themselves. And last but not least, "The Lafayette Escadrille" shares insight into a how a group of documentary filmmakers are using giant-scale RC models to enhance their film about the volunteers who became the first Americans to engage in aerial combat; after reading Mark Wilkins's account, the MAN crew is definitely looking forward to the finished documentary.

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EDITORIAL

Executive Editor Debra Cleghorn >> debrac@airage.com

Senior Technical Editor

Gerry Yarrish >> gerry@airage.com

West Coast Senior Editor John Reid >> johnr@airage.com

Associate Editor Matt Boyd >> mattb@airage.com

Copy Editor Suzanne Noel

CONTRIBUTORS

Jason Benson, Sal Calvagna, Budd Davisson, Don Edberg, Mike Gantt, Dave Garwood, Dave Gierke, Greg Gimlick, John Glezellis, Aaron Ham, Carl Layden, Clarence Lee, Jim Newman, Greg Poppel, Mark Rittinger, Jim Ryan, David Scott, Jerry Smith, Craig Trachten, Paul Tradelius, Pat Tritle, Rich Uravitch, Michael York, Nick Zirolli Sr.

ART

Creative Director Betty K. Nero

Art Director Kevin Monahan

DIGITAL MEDIA

Web Producer Holly Hansen

VIDEO/PHOTOGRAPHY

Photographer Peter Hall

Videographer Adam Lebenstein

ADVERTISING

Strategic Account Manager Mitch Brian

>> 203.529.4609 | mitchb@airage.com

Interactive Account Executive Joe Corrado

>> 203.529.4636 | joec@airage.com

Interactive Account Executive Jane Tacca

>> 203.529.4628 | janet@airage.com

CONSUMER MARKETING/PRODUCTION

The Media Source, a division of TEN,
The Enthusiast Network

MARKETING & EVENTS

Marketing Assistant Erica Driver

Event Manager Emil DeFrancesco

PUBLISHING

Group Publishers Louis V. DeFrancesco Jr.,
Yvonne M. DeFrancesco



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Comments may be sent to: MAN@airage.com



EDITORIAL OFFICE

88 Danbury Road, 2B, Wilton, CT 06897 USA

EMAIL MAN@airage.com



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We love hearing from our readers: Your emails, tweets, and comments quickly let us know what you'd like to see more (or less!) of in upcoming issues and online. Here's what some of you are saying about *Model Airplane News* magazine.

Facebook Thrust-Vectoring 3D Turbine Jet

We are always on the lookout for exciting videos, and this one really grabbed your attention. When jet guys add thrust-vectoring nozzles to their aircraft, the aerobatics really get wild. This impressive bit of piloting shows Steve Johnson having fun with his amazing CARF-Models Chengdu J-10 3D. Powered by a Behotec 220 turbine engine and with the thrust-vectoring tail nozzle, this jet really does live up to its NATO code name: Firebird! Thanks to Tbob Pete for posting the video. Here are some of your comments:



SM: Looks like me trying to get straight and level flight.

KLS: I've tried those maneuvers; still have the pieces to prove it.

CR: This supports the case that, with enough thrust, anything can fly.

BC: That's awesome! I want one.

WT: 40+ years flying, never seen anything like it!

JB: Pilot got some skilz!



ModelAirplaneNews.com Florida Jets

Longtime MAN contributor and expert RC jet enthusiast Rich Uravitch traveled to Paradise Field in Lakeland, Florida, to cover all the action for us at the 2017 Florida Jets event. Rich's article was published in the July issue of MAN, but we could not print all of his exciting images in his report. There were lots more, so we posted a highlight featuring more than 60 images, showing off Rich's camera handiwork. Here's what some of you had to say:

Robert Belcher: I have the desire, but not the deep pockets.

Tammy Kingsley: Talk about boys with their toys! But I have to admit, these are a lot more than just model airplanes.

Adam Sullivan: I remember when all the jets were powered by high-revving nitro-burning engines. They would eat up a glow plug on every flight.

George Phillips: Beautiful jets indeed. Their performance is unbelievable.

Pete Williams: Shut up and take my money!

Carl Johnson: I'd love to fly jets, but my flying field is way too small for their safe operation.

In Our Mailbox Really Big Triplane

At my last club meeting, a friend showed me an article in MAN that showed off a really big triplane. I believe it was built by Bill Holland, who is the chief judge at Top Gun. Can you please tell me where to find it, and if possible, give me some information on the model?—Charlie Manny, via email

Hey, Charlie. The Reader Gallery on Bill Holland and his big beautiful red triplane was in the June issue. Bill built the 50 percent scale triplane from enlarged Glenn Torrance Models plans. During the build, Glenn also helped out by providing some custom-made parts for the half-scale Fokker. Powered by a twin-cylinder 3W 275cc gas engine, the triplane is covered with Poly-Fiber aircraft-grade Ceconite fabric, and it weighs in at 120 pounds, so it will need an AMA Large Model exemption. You can get a back issue from AirAgeStore.com.—GY





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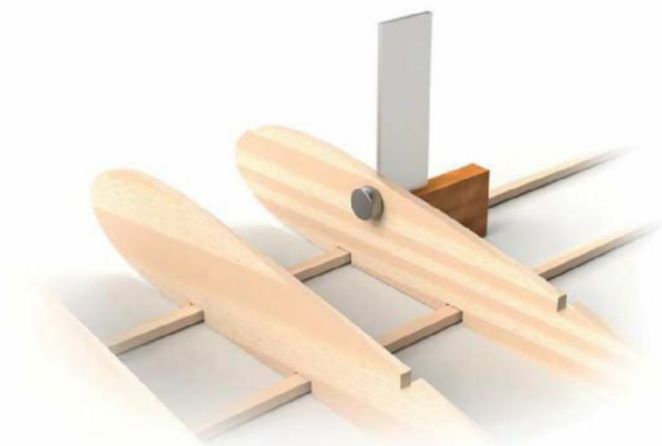
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MAGNETIC SQUARE

To precisely position and hold your wing ribs in place, use a small dot magnet on one side of your wing rib and a metal right-angle square on the other. The magnet creates enough holding force to secure the rib firmly against the square so that your hands are free to align the rib with the plans and glue it to a spar. The magnet allows holds a slight downforce to keep the rib firmly in place as the glue dries.

Jeff Grant, via email



CERTIFICATE ON DEMAND

So that I don't forget to bring my FAA certification card with me to the field, I fold it up and put it inside the battery compartment of my transmitter!

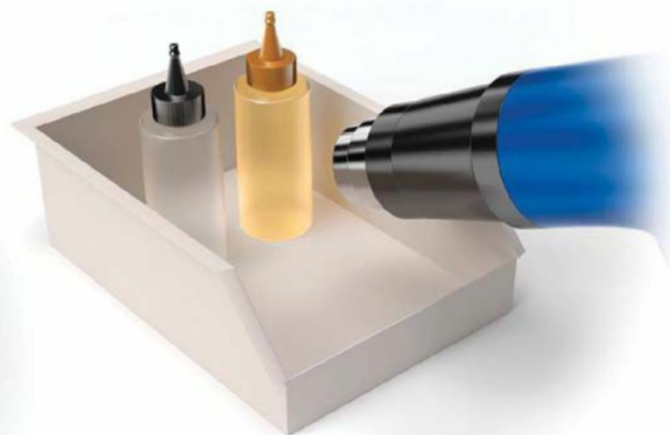
Dave Fishman, Ojai, CA



TAPE TRAP

When you repair your airplanes, you often have to remove small nuts, bolts, and screws to reach broken parts. Those items can be easily lost or pushed off the workbench during your repair. To prevent losing what you have on hand, place a roll of masking tape on your workbench and deposit your hardware parts inside. Not having to hunt for something that hit the floor and bounced into a black hole also speeds your repair time.

Michael C. Gross, Mastic Beach, NY



WARMING EPOXY

In a cold workshop, epoxy can get very thick and not run easily, making it difficult to mix accurately. I heat up my epoxy bottles with a covering heat gun or a hair dryer. Place the bottles in a box to contain the heat and, in a couple of minutes, the resin will thin. Wait a little bit for the bottles to cool off, then get your mixing cups and mix the two parts together. The heated resin is easy to mix and brush on, and penetrates the wood better. The heat does reduce the working time a bit, so make your joints quickly before the resin begins to gel.

Edwin Hawk, Smithville, OH



SEND IN YOUR IDEAS! We want your ideas for Tips & Tricks! This month's winners will receive a *Model Airplane News* baseball cap. Send a photo or rough sketch and a brief description to MAN@airage.com or *Model Airplane News*, c/o Air Age Media, 88 Danbury Rd., Wilton, CT 06897 USA.

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S-3 Viking Mark Kikta, Lothian, MD This 60-inch-span S-3 was built from a Keiro models balsa kit. Mark used twin Wemotec 70mm Mini EVO fans with twin Castle 100-amp speed controls powered by two 4S 5000mAh LiPos, and added custom air-powered retracts from RC Crafters. The S-3 is covered with UltraCote, which Mark sanded and painted in the Navy low-visibility gray paint scheme. Mark actually flew this full-size aircraft in the U.S. Navy for 26 years and was the commanding officer of this squadron during Operation Desert Storm onboard USS America (CV-66).



Contender

Ted Spillers, Breaux Bridge, LA

Ted originally built this model with his father in the mid-'70s and recently rebuilt it when he became interested in RC again. He writes, "Just finished and flew it; it flies just like it did 40 years ago." Ted's six-year-old granddaughter, Eva, is holding the refurbished plane.

Dago Red

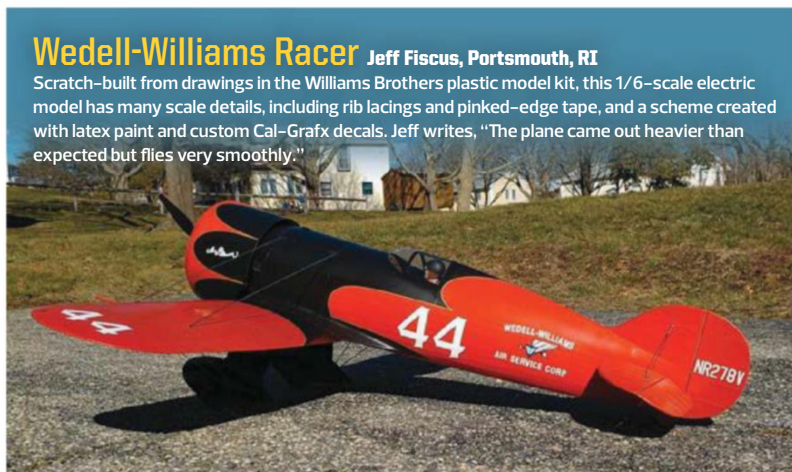
Paul Whiteman, Hastings, ON, Canada

When a flying buddy ripped out the landing gear on a Top Flite P-51, Paul took the wreckage and extended the race canopy, updated the instrument panel, affixed lights, created custom decals, and added synchronized landing gear with doors. He notes that his Dago Red has "hangar queen" status until he becomes a more proficient pilot.



Wedell-Williams Racer

Jeff Fiscus, Portsmouth, RI
Scratch-built from drawings in the Williams Brothers plastic model kit, this 1/6-scale electric model has many scale details, including rib lacings and pinked-edge tape, and a scheme created with latex paint and custom Cal-Grafx decals. Jeff writes, "The plane came out heavier than expected but flies very smoothly."



SEND IN YOUR PICTURES! Model Airplane News is your magazine, and we encourage reader participation. Email your high-resolution images to MAN@airage.com, with your contact information and details on your project. Every pilot we feature will receive a Model Airplane News baseball cap, and the "Pilot Project of the Month" winner will receive a Model Airplane News "swag pack."

Honoring the 75th Anniversary of the B-17 Flying Fortress

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A Salute to Democracy’s Flying Fortress

During World War II, victory wasn’t a given. It took blood, sweat, tears, and the mighty muscle and innovative design of a legendary aircraft to keep freedom soaring. Now you can salute the 75th anniversary of the iconic aircraft that flew “The Greatest Generation” to victory, with *The 75th Anniversary of the B-17 Flying Fortress Bomber Silver Crown* from The Bradford Exchange Mint.

The reverse of this magnificent legal tender coin showcases a winged 75th anniversary logo. It’s joined by powerful B-17 imagery by American coin and aviation artist Joel Iskowitz. America’s storied four-engine heavy bomber began its wartime service in 1941. First deployed by the Royal Air Force, it served the Allies with distinction in most every combat zone. The B-17 was revered for its ability to keep flying, even with damage, and bringing its crew home. The obverse features Her Majesty Queen Elizabeth II, marking it as official legal tender of Tristan da Cunha. Lavishly plated in genuine silver, your coin arrives in coveted Proof condition, preserved for posterity in a crystal-clear holder. Don’t miss this chance to acquire this striking tribute as well as additional issues to come in *The All-New 75th Anniversary of WWII Bombers Silver Crown Collection*.

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The Lafayette Escadrille

Using RC aircraft in a new documentary

BY MARK WILKINS

A quarter-scale Nieuport 11 is filmed using a Chroma quad by drone pilot David Brow. Gauging how close the plane is to the drone using line-of-sight flying is tricky, which makes using FPV all the more important.



A period photograph of the *Escadrille Américaine*—later changed to the Lafayette Escadrille. These brave Americans fought for France well before the United States entered the war in 1917.

The Lafayette Escadrille was a group of American volunteers who found themselves thrust together in the middle of a war unprecedented in scale and horror that caught them—and indeed the world—by surprise. Youth and the lust for adventure drove these young men to France while thumbing their noses at their neutral homeland. Each had great expectations and responded differently to the crucible of war. Some were from privileged backgrounds and some were adventurers, but most were seemingly aimless until the war brought their lives into sharp focus. All of these men possessed courage to varying degrees, and what they did then still resonates with us today. They were the Lafayette Escadrille—the first Americans to ever engage in aerial combat. The documentary I am involved with aims to honor these men as being more than pawns for a cause. Our goal is to describe them as human beings—with all their



attendant flaws and strengths, untainted by exaggeration or stereotype.

THE DOCUMENTARY

The film is comprised of interviews with historians, authors, and extended family members of the Escadrille pilots. All of these people lend unique



Is it a model or a full-size aircraft? Camera angle, level of scale detail, and type of flying all contribute to creating the illusion that a model is a full-size aircraft. Often low camera angles will make a model appear as a full-scale aircraft, whereas high camera angles can make a real plane look like a model!

insight to the story and tell it a very different way than it has been told in the past. The film is being produced by Humanus Documentary Films Foundation, a nonprofit organization based in Los Angeles, California. Humanus also produced the documentary *The Millionaires' Unit*, which will be released soon. Our advisory board consists of two retired Air Force chiefs of staff, members of the U.S. World War I Centennial Commission, relatives of the pilots' families, and Escadrille scholars.

One of the biggest challenges we face for this project is to give the viewer an accurate sense of what flying and fighting must have been like—really like. Flying one of these frail machines of canvas and wood was, in itself, a minor miracle, and add to that the dynamic, terrifying, and unknown element of combat. There was no template to follow. These men worked it out in real time, using their hides as collateral—if they succeeded. A new combat technique was born; if not, they perished. The resultant experience is a feat of almost unimaginable determination and

resolve, especially when compared and contrasted with the computerized UAV (unmanned aerial vehicle) warfare of today. We aim to put the viewer in that fragile and completely exposed cockpit, to let them vicariously and, if only for a few moments, believe. To do this, we are filming full-scale aircraft and using archival photographs and RC models.

OUR TEAM

Our team of Darroch Greer, Paul Glenshaw, Dan Patterson, and I were out at Dayton, Ohio, for the Dawn Patrol rendezvous last fall, where we filmed numerous WW I—replica aircraft flying. We recognized just how well large RC scale models could be used to simulate actual aircraft. At times, you just couldn't tell the difference!

Paul and I are old friends. We both worked in museums in the



A replica Nieuport 11 was just one of many replica aircraft at the Dawn Patrol rendezvous at Wright Patterson Air Force Base in Dayton, Ohio, last fall. There were also many RC World War I aircraft, some of which were large and confirmed our theory that models could stand in for full-scale planes.



Left: Drone pilot David Brow chases a BUSA Eindecker flown by a club member at my flying club. Getting close and staying just close enough is the trick here.

Below: The cockpit of my 1/4-scale Nieuport 11 is fitted with a removable deck that serves as a platform for a GoPro camera. The movie plane will have a similar arrangement to this but with a greater emphasis on what the camera will see.



Washington, D.C., area, and we both shared a love of airplanes and aviation history. In grad school, where I earned a masters in history, I really got excited about WW I history and, about this time, began building WW I RC models. When the team received a grant to help get the film started, Paul called me and I became part of the team.

PRACTICAL SPECIAL EFFECTS

Working with full-size aircraft is great when they're available because they can do one thing a model can't: contain a human being. So for ground sequences, it was crucial to use full-size aircraft, especially when people were in close proximity. But most historic and replica aircraft are not allowed to do aerobatic maneuvers—the risks are just too great. So the modern approach to solve this problem of stunt flying is to use computer-generated images (CGI) and models. Besides its expense, there is something very "digital" about CGI imagery that we wanted to avoid. We will film flying airplanes. So this is where the models become critical because they are able to perform stunts with impunity—no huge insurance costs and no potential risk to human life.

RC MODELS

Using scale aircraft is not without challenges, however. To do it well, the aircraft have to fly in a scale fashion, and that means much more slowly than most RC pilots fly. So airspeed and altitude metrics become critical. An aircraft may look like it's flying very slowly and about to stall, but airspeed will tell you it isn't. And due to the inherent shortcoming of line-of-sight flying, depth perception, and silhouetting, first-person-view (FPV) cameras have become very important. To pursue an RC airplane accurately during a dogfight sequence, you really need that from-the-cockpit view looking toward your opponent. This poses difficulties because small FPV cameras used for flying are not of film quality. To get the required high-definition footage, we needed to use cameras like the GoPro HERO, and all of this equipment had to fit inconspicuously in the cockpit.

ON MY WORKBENCH

I am currently building a couple of movie models. They are a 1/3-scale Nieuport 11 and a SPAD S.XIII, and they'll have a few important criteria.



A SPAD S.XIII-inspired aircraft and two 7/8-scale Nieuport 17 replicas on the flightline of the Dawn Patrol event. The Nieuports were built from kits of riveted tube and sheet aluminum and steel available from Airdome Aeroplanes in Holden, Missouri.

MOST HISTORIC AND REPLICA AIRCRAFT ARE
NOT ALLOWED TO DO AEROBATIC MANEUVERS—
THE RISKS ARE JUST TOO GREAT.

Our team filming Nieuport 17s, belonging to Tom Martin and Rick Bennett, in Belgian colors at an undisclosed location in rural Ohio. These flat plains and cornfields look a lot like rural France!



Chief among these is that, to fool the eye, they will have to look exactly like a full-size airplane. To help do this, they will need to have dirty,

well-worn airframes, with the scale markings from the Lafayette Escadrille pilots. The ailerons for the Nieuport are actuated by torque tubes

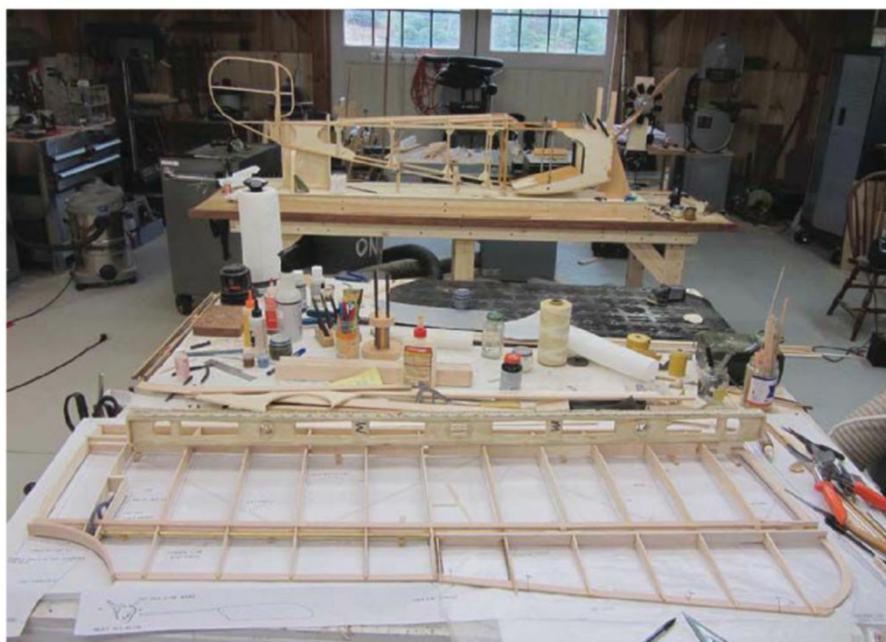
and bellcranks, and the rudder and elevators all have pull-pull cables, just like their big siblings.

The other important factor that is driving the airplanes' construction is the FPV component. Everything the camera sees drives the construction details. For example, the inside of the windscreen has to be exactly scale, as does the underside of the top wing, which will be detailed with closely spaced rib stitching. Also important is what we don't want you to see: No servos, receivers, etc., can be visible; it all must be hidden from view. The batteries (one set for the engine, one for the servos, and one for the sound module) are all up against the firewall or hidden by the dummy fuel tank.

Another aspect of the project is to use FPV-equipped camera drones. These will be used to capture authentic-looking air-to-air footage to be included with the footage shot from our FPV-equipped RC WW I aircraft.

PRODUCTION CONTINUES

Sponsorships and funding continue to be sought for the film. Some model companies have generously donated or discounted parts and equipment. Hitec, Williams Bros, IFly Tallies, and Benedini sound modules have all contributed. We are halfway through production, and the target completion date



A scratch-built 1/3-scale Nieuport 11 grows in my shop. In the foreground is the starboard upper wing panel, with torque tube built into the wing structure. In the background, the fuselage is taking shape. In the far distance, our Le Rhône rotary is on the test stand. To see progress of these models, visit Dawn Patrol RC on Facebook.

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FPV-EQUIPPED
CAMERA DRONES
WILL BE USED
**TO CAPTURE
AUTHENTIC-
LOOKING AIR-TO-
AIR FOOTAGE** TO BE
INCLUDED WITH THE
FOOTAGE SHOT FROM
OUR FPV-EQUIPPED
RC WW I AIRCRAFT.



Drone footage of a Nieuport 17 cruising around the flying field. New technologies, such as drones, GoPro cameras, and FPV flying, open up a whole new realm for filmmaking. Visit our Facebook page at Lafayette Escadrille Documentary.

is by the end of 2018. If you or someone you know would like to help with this film either by funding or offering gifts in kind, please let

us know. For more information on Humanus Documentary Films Foundation, please visit the website at humanusdocumentaryfilms.org.

For more information about the film, visit thelafayetteescadrille.org. ✈

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Phoenix Model Outrageous ARF

A great sport flier with pylon-racing looks

BY SCOTT COPELAND PHOTOS BY GERRY YARRISH



When Glenn Curtiss rounded the final pylon in Reims, France, to win the first Gordon Bennett Cup in 1909, a trend had been established in the fledgling field of aviation: the need for speed! The epitome of modern handmade racing aircraft is the class known as Formula 1, and Phoenix Model's new Outrageous ARF captures the tenacious looks and aggressive flight performance of these menacing speed merchants.

Outrageous is constructed of traditional balsa and ply materials and covered in Oracover. The kit comes with two-piece plug-in wings that are attached to the fuselage via an aluminum wing-joiner tube. Also included are a painted fiberglass cowl, preformed main landing gear and tailwheel, painted fiberglass wheel pants, wheels, a spinner, and all hardware necessary to get Outrageous ready for the flying field. Mounting accessories are provided to allow the modeler to use either electric or glow power. The cockpit contains some nice details

including a pilot figure and instrument panel. The large main hatch attaches with a spring-loaded pin and allows access to all radio gear, batteries, and fuel tank (if glow power is used).

Outrageous is highly prefabricated and is supplied with a thorough instruction manual. It is intended for intermediate builders and pilots, and should not present any major headaches during assembly or flying. Although this aircraft is not recommended for first-time modelers, those with prior models under their belt should feel confident purchasing this kit.

AT A GLANCE



MODEL

Outrageous Pylon Racer ARF



MANUFACTURER

Phoenix Model (phoenixmodel.com)



DISTRIBUTOR

Tower Hobbies (towerhobbies.com)



WINGSPAN

61 in.



PILOT SKILL LEVEL

Intermediate



ASSEMBLY TIME

2.5 hours



RADIO REQ'D

4-channel w/ four to five standard servos



POWER REQ'D

1000-1400W 480Kv electric motor or .46-.55 two-stroke/.52 four-stroke



PRICE

\$159.99



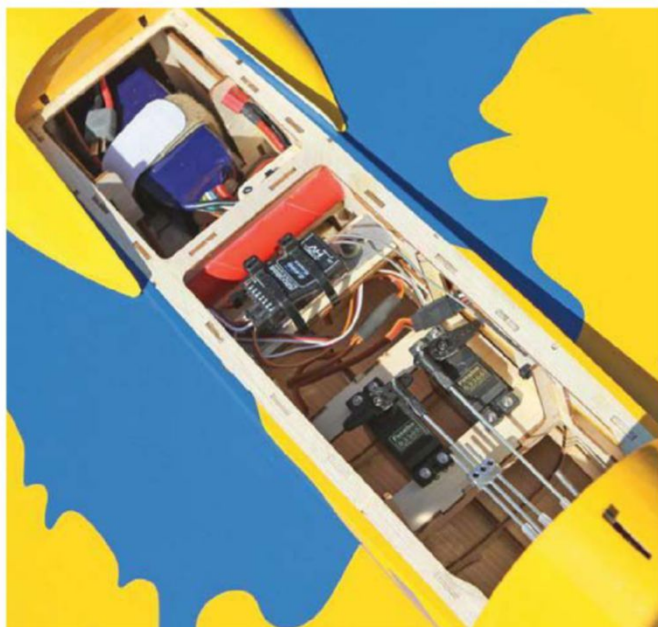
WHAT WE LIKE

- + Sport-scale appearance and flight performance
- + Electric or glow power
- + Large hatch for easy battery and radio access
- + Highly visible color scheme

BEING AN AERODYNAMICALLY CLEAN AND EFFICIENT
DESIGN, THE OUTRAGEOUS IS HAPPY AT ANY SPEED.



The author and his Outrageous await their turn on the flightline.

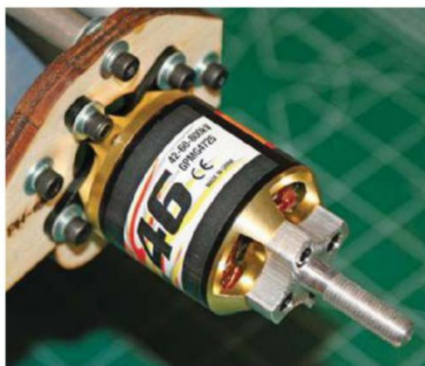


Left: Removing the hatch allows access to radio gear and motor batteries.

Above: Frontal view of the Outrageous shows off its aggressive stance and distinct cowl shape.



The tidy installation of the speed control above and behind the firewall keeps it in the cooling airflow.



The RimFire 46 brushless motor is attached to a secondary firewall that's secured with standoffs. All hardware is included in the kit for electric or glow installations.



A short, stout aileron pushrod linkage provides precise control.

UNIQUE FEATURES

It is always a good idea to peruse the instruction manual prior to airframe assembly to become

familiar with the parts themselves and visualize the construction sequence. It's no fun to have to take things apart and reassemble them especially when the error is avoidable. The preshaped aluminum landing-gear legs mount easily into the fuselage with four 20mm bolts, which thread into blind nuts premounted in the fuselage. Four small swatches of covering must be removed using a hobby knife to install the landing-gear legs. The fiberglass wheel pants mount along with the wheels to the threaded axles supplied in the hardware package. A small groove must be cut to allow the wheel pants to slide over the axles. Alignment is automatic thanks to the channel molded into the wheel pants, where they mate to the landing-gear legs.

All the control surfaces are slotted for CA hinges and require only a drop of thin CA to fix them permanently in place once proper alignment is achieved. Servo installation for standard-size rudder and elevator servos (and throttle if required) is easily completed with the requisite drilling of mounting holes for the servo-mounting screws. Aileron servos are

fastened to removable hatches under each wing. The receiver was fixed to the top of the wing-mounting plate with a patch of Velcro and two cable ties to keep it secure.

The cowl is perhaps the most distinctive feature of Outrageous. It is good-quality light fiberglass and comes painted to match the fuselage covering. It is mounted to the firewall with four screws. The rear cowl contains recesses that are molded accurately to accept the wing's leading edge. For electric power, no cutting is required, but for glow installation, openings will need to be cut for clearance of the cylinder head, muffler, and carburetor and for access to the needle valve. The shape and location of these openings is detailed in the instruction manual. The cowl itself is quite spacious and allows more-than-adequate air circulation around the motor/speed control or engine.

For the mounting of a .46- to .55-size glow engine, fiberglass engine mounts and the required bolts, washers, and locknuts are provided. The electric-power installation uses a

GEAR USED



RADIO

Futaba T8J transmitter w/ R2008SB receiver and four S3305 servos (futabarc.com); Hobbico LiFeSource 6.6V 1100mAh 10C receiver battery



MOTOR

ElectriFly RimFire .46 (electrifly.com) w/ Great Planes Silver Series SS-80 speed control



PROP

APC L10050 10x5 Sport (apcprop.com)



BATTERY

Turnigy Nano-Tech 6S 2200mAh 25-50C (hobbyking.com)

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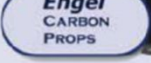
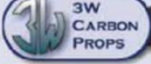
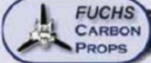
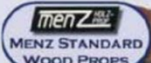
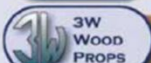
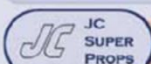


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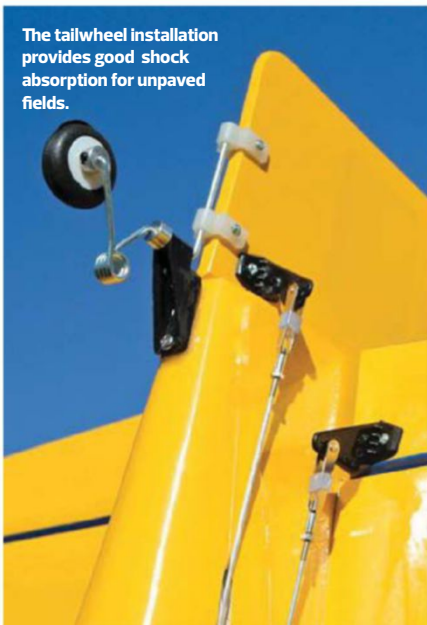


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Prices subject to change without notice.

The tailwheel installation provides good shock absorption for unpaved fields.



The main landing gear shows its simple, rugged installation. Wheel pants add a touch of class and help minimize drag.

secondary firewall fixed to the primary firewall with standoffs. Again, all necessary hardware is provided in the kit. The trickiest part of mounting our ElectriFly RimFire .46 was assembling the secondary firewall, which is as simple as laminating three pieces of plywood together.

Although assembly was by no means difficult, I did find it necessary to deviate from the instructions during tail assembly. The horizontal stabilizer slides sideways into a groove at the rear of the fuselage. The procedure outlined in the manual calls for epoxy to be applied to the top and bottom of the stabilizer-mounting area in the fuselage, after which the stabilizer is slid into place. There is no way to slide the stabilizer into position without getting epoxy all over the covering. I decided, instead, to assemble and align the stabilizer and glue it in place with CA. If the model is to be glow powered and you prefer to use epoxy to fix the stabilizer in place, I would suggest masking off 1/8 inch above and below the joint between the fuselage and stabilizer and applying a small fillet of epoxy between the strips of masking tape.

A Brief History of Formula 1 Air Racing

Glenn Curtiss, with his victory in Reims at the blistering pace of 46mph, threw down the proverbial gauntlet to speed-minded aviators around the world. Four years later, in the last Gordon Bennett Cup held prior to World War I, the

winning speed had improved to 125mph! Air racing before and immediately following WW I was largely the game of "shade tree" aviators. These men and women often built their own aircraft or modified existing engines and airframes to quench their thirst for speed. As more ex-military machines began showing up on the racing circuit, it became more difficult for the average race pilot/mechanic to remain competitive.

In 1936, a new race class was proposed to level the playing field. This class was known initially as "midget racing," and all competitors needed to comply with specific design specifications to be legal for competition. Present Formula 1 rules limit engine displacement to 200ci, require a minimum wing area of 66 square feet, and an empty airframe weight of at least 500 pounds. All aircraft must have fixed landing gear and a fixed-pitch propeller. Aircraft race around a 3.19-mile oval course. Some classic designs in the F1 style are Art Chester's Jeep and Steve Wittman's Bonzo. More modern recognizable designs include the Cassutt Special, Sharp Nemesis, and Shoestring. There also exists a full-scale Outrageous F1 racer, which is France's first Formula 1 entry since 1936!



DAVID LEDNIGER / AIRLINERS.NET

During radio installation, I also found it necessary to modify the rudder horn. Because the rear fuselage is markedly wider than the rudder itself, the standard control horn hit the fuselage during right-rudder input and did not allow full rudder deflection. The control horn was easily modified with a Dremel sanding drum to increase clearance as shown in the photos.

IN THE AIR

Flight testing was conducted on a beautiful early-spring morning with clear skies and light winds. After the first two attempts resulted in mild nose-overs, the Outrageous was given a firm push at full throttle and off into the wild blue she went! The power system had plenty of oomph to replicate the "go fast, turn left" flight pattern of a full-scale F1 racer.

GENERAL FLIGHT PERFORMANCE

Stability: The wing's NACA airfoil (although the manual does not list the specific airfoil number) gives the airplane smooth tracking through the entire flight envelope.

Tracking: Once trimmed for level flight, the Outrageous is very smooth and predictable. Aileron and rudder response is crisp, but elevator response gets slightly mushy at slow speed.

Aerobatics: I always conduct test flights with standard control-surface throws as

recommended in the manual with no dual rates. Even with standard surface throws, Outrageous corners very well and can make tight but scalelike turns, as a pylon racer should. Loops, rolls, Immelmann turns, stall turns, and Cuban-8s are all within this airplane's capability. Programming dual rates and expo should significantly expand the aerobatic capability of the Outrageous.

Glide and stall performance: Being an aerodynamically clean and efficient design, the Outrageous is happy at any speed. We flew the airplane in tight circles in both directions at relatively slow speed, and it showed no signs of the deadly tip-stall. The wingtip design assuredly helps in this area. During landing approach, speed must be maintained as the elevator gets proportionally less effective as speed is reduced. The addition of a little power just before touchdown will help with landing flare.

PILOT DEBRIEFING

If flying from a grass field, full up-elevator should be held during the initial takeoff roll to keep the airplane from nosing over. Due to the relatively small surface area of the elevator, it would be prudent to program dual rates and expo for the first flight to give the pilot the option of having more elevator control available, just in case.

BOTTOM LINE

With classic pylon-racer looks, eye-catching color scheme, and dazzling flight performance to boot, the Phoenix Model Outrageous is a wonderful choice for sport-scale fun! Whether you prefer to fly speed passes of the field or an aerobatic circuit like a Red Bull racer, the choice is yours. Electric or glow, blistering fast or scalelike slow, the Phoenix Model Outrageous will not disappoint. ±



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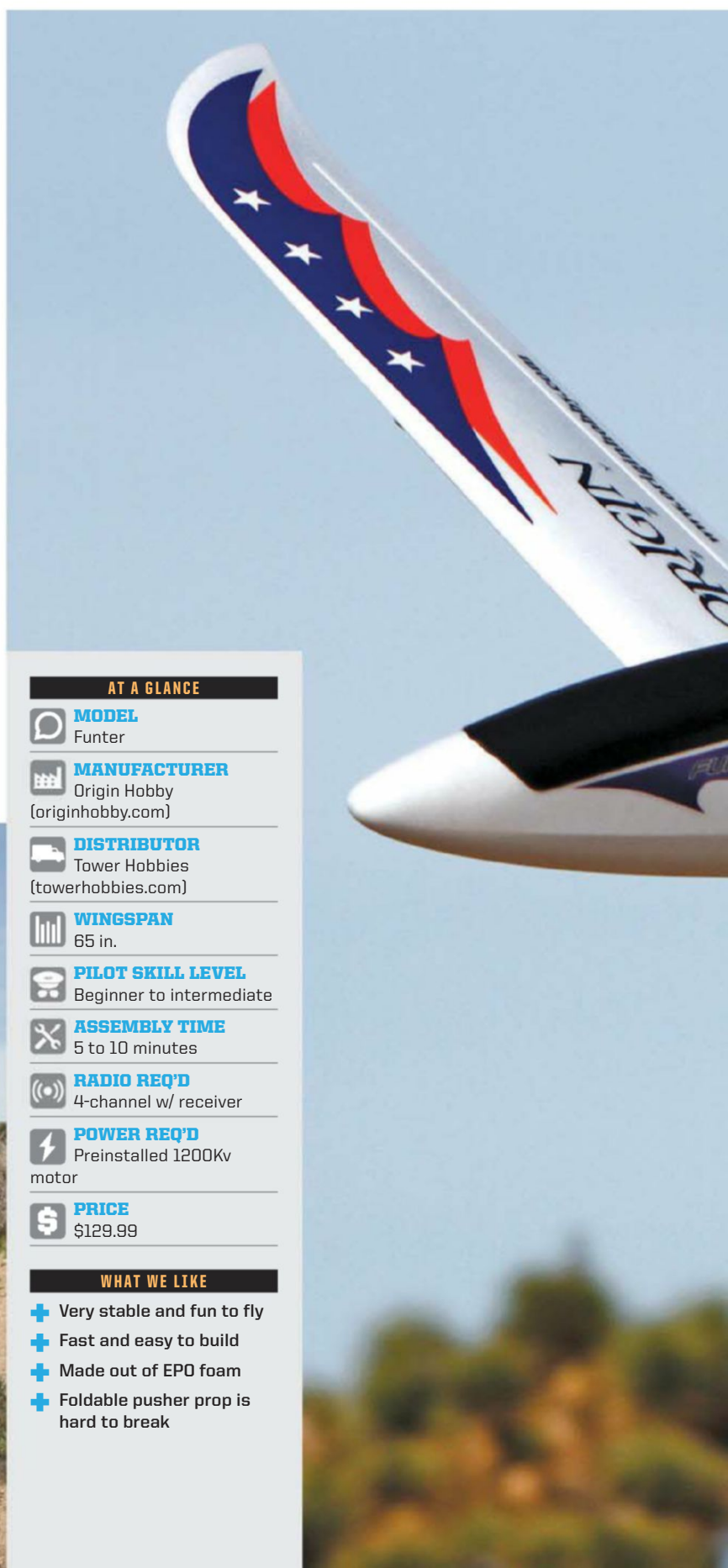
Soar with the birds or buzz the tower—the choice is yours with this powered glider

BY CHRIS BARRETT PHOTOS BY JOHN REID



This low-wing pusher-style glider is one of my favorite airframes. It is stable, easy to fly, and pretty much maintenance-free. It also glides very well, so it doesn't require a lot of speed to stay up in the air—nice for cruising around to catch thermals. That said, once you get tired of cruising, it still has the performance and control to let you get in some sport flying. This makes it my go-to plane for a quick flight around the house from the front porch. Throw a small camera on a couple of these and it's a lot of fun to chase each other around, as well.

When you have a nice-flying plane that requires minimal build time, you know it's going to be a good day.



AT A GLANCE



MODEL

Funter



MANUFACTURER

Origin Hobby
(originhobby.com)



DISTRIBUTOR

Tower Hobbies
(towerhobbies.com)



WINGSPAN

65 in.



PILOT SKILL LEVEL

Beginner to intermediate



ASSEMBLY TIME

5 to 10 minutes



RADIO REQ'D

4-channel w/ receiver



POWER REQ'D

Preinstalled 1200Kv
motor



PRICE

\$129.99

WHAT WE LIKE

- + Very stable and fun to fly
- + Fast and easy to build
- + Made out of EPO foam
- + Foldable pusher prop is hard to break

THE TAKEOFFS ARE EFFORTLESS: FULL THROTTLE AND
A GOOD TOSS HAVE THIS PLANE CLIMBING TO
THE SKY. LANDINGS ARE JUST AS EASY.





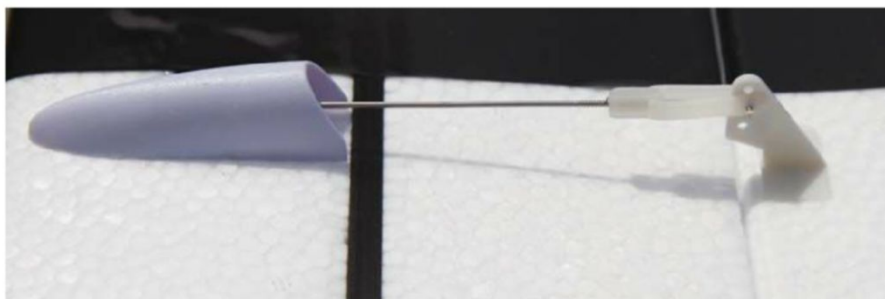
The folding pusher prop is nearly impossible to break—unless you're in the habit of landing upside down and backward.



The FlightPower 3S 2200mAh LiPo fits perfectly in the nose.



The fuselage has plenty of space for your receiver and other electronics.



The aileron controls come preinstalled and protected.

Having flown a few different brands in this style, I can easily say that Origin Hobby did a fine job of putting the Funter together. Built out of EPO foam, it is light and durable, making it one of those planes that you don't stress about. Just about everything is included in the box; all you need is a battery and your favorite

receiver / transmitter combo to get this puppy flying. It's a great plane for beginners to learn on and improve their skills, while still being fun for intermediate to advanced pilots.

UNIQUE FEATURES

The overall fit and finish of the Funter is clean, and it looks nice. The EPO construction feels sturdy and is capable of taking a beating, so it can handle some rough landings or getting tossed in the back seat of a truck. On top of that, just about everything is done for you from the factory. All the electronics are preinstalled, and no glue is necessary to complete the tail section—the horizontal and vertical stabs just slide together and screw on. This plane had a little lip on the plastic insert for the tail, so it would snag when I was trying to install it. Shaving off a tiny bit of the lip using a knife, however, was all that was needed to get it together.

Although this powered glider doesn't come standard with flaps, there are outlines in the ailerons showing where to cut for flaps and even a cutout space in the wing for the servos.

Adding flaps is as simple as ordering the parts. One thing to keep in mind, though, are the foam hinges. From experience, they will work fine for quite a while and then you might notice the foam starting to come apart. I recommend throwing in some plastic hinges before you get to that point. You'll end up with cleaner lines and more peace of mind than if you wait.

The wings push together easily and are supported by a carbon-fiber rod. There are a few screws, one on each wing, that clamp down on the rod to hold them in place. Installing them is quick, and they have a nice strong hold. The fuselage has plenty of space, which makes it easy to fit all your electronics without a lot of finagling. The best part about it, though, is that it has a long canopy covering the fuselage, so battery changes are effortless and there isn't a lot of fishing to get the aileron servo leads in while installing the wings. The canopy is held on by a strong magnet, so there shouldn't be an issue with it flying off. A nice little finger hold at the back of the canopy allows for easy removal without pinching or damaging the foam. Another nice feature is the folding pusher

GEAR USED



RADIO

Futaba T8J w/ R2008SB receiver (futabarc.com); four 9g servos (installed)



MOTOR

2830 1200Kv brushless w/ 30A speed control (installed)



PROP

8x6, folding (included)



BATTERY

FlightPower 3S 2200mAh 30C (flightpowerbatteries.com)

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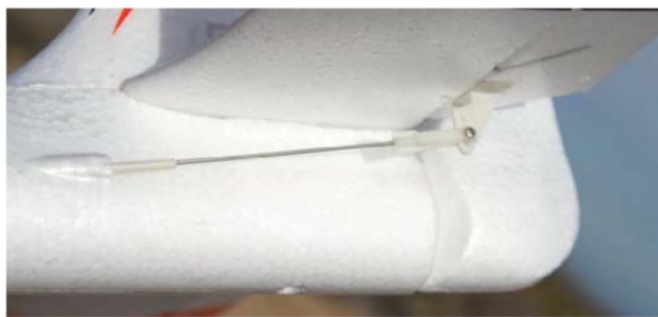
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The carbon-fiber spar slides into the wing and locks down with a screw on each side.



Minimal adjustment is required to get the control surfaces level right out of the box.

prop. Its position on the plane makes it almost impossible to break, and because the plane lands on its belly, that is a big bonus.

IN THE AIR

The Funter can be flown just about anywhere there is some space, and because it is a belly lander, there is no need to worry about what type of terrain you are flying over. The takeoffs are effortless: Full throttle and a good toss have this plane climbing to the sky. It is quick to gain altitude, which is why you don't need a whole lot of area in which to take off. Landings are just as easy: Throttle off and let it glide down to you. It does glide really well, so you'll need to base your flight area on how well you can scrub speed and how precise you can set the plane down. Since it is a belly lander and it doesn't need a whole lot of speed to stay in the air, the landings aren't too critical. Set it down slow or even catch it if you are comfortable with that.

GENERAL FLIGHT PERFORMANCE

Stability: Since this plane is made out of foam and is fairly light, the wind does push it around a

bit, but it experiences nothing more than a little movement. It can handle some pretty strong winds, and all you'll see is a little up and down. It won't roll it over or do anything weird, which makes this plane very stable at low and high speeds.

Tracking: With all the control surfaces fairly straight, all this Funter needed was a little trim on the elevator to have it tracking straight and level. Since it does have the pusher motor, "power on" tends to force the plane down a bit—nothing crazy, but it is something to note. Your trim will depend on how you want to fly. Other than that, this plane holds its line well.

Aerobatics: This plane doesn't need a whole lot of speed to stay in the air and it has plenty of

power for its size, so it can handle pretty much all of your sport-flying maneuvers.

Glide and stall performance: This plane glides well, and stalls don't lead to anything crazy. The nose drops pretty level, and the plane doesn't try to roll over. Since it doesn't need a whole lot of speed to fly, stalls are easy to recover from.

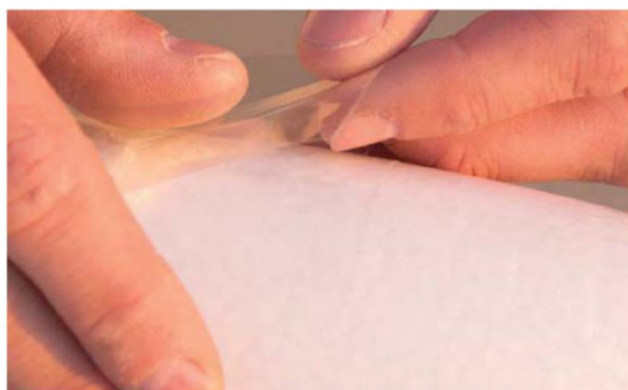
PILOT DEBRIEFING

Overall, the Funter is a lot of fun to fly. From quick sport flying to cruising around in thermals, it handles very well. Its flight characteristics are predictable and very forgiving, so it is a great plane with which to hone your skills.

Tape It Up

With belly landers or pretty much any foam constructed plane, there comes a time when you need to set it down on the ground. EPO foam is strong and capable of taking a beating, but that doesn't mean you won't see some damage to the surface. If you're like me and don't have a convenient grass field to land in or aren't always spot-on with your catches, then you need to look for a little protection if you want to keep the underside of your plane clean. I fly mostly above dirt or asphalt, so if I land on the ground, it's going to scratch or even chunk little pieces of foam. Again, it's not a big deal unless you want to keep your plane looking nice.

The simple solution: just put a strip of packing tape on it. There are plenty of other protective options out there, but I like to keep it fast, inexpensive, and simple when it comes to protecting my foamies. For me, tape is fast, protects the surface well, and can be easily ripped off and replaced when it comes time. Obviously, this isn't the best case if the foam is painted (I still use it), but if it's plain foam, then there is nothing to worry about. One strip on the bottom is all it takes, and you can change it out when it starts to get shredded.



BOTTOM LINE

Origin Hobby did a nice job of putting together the Funter. It is a quick-and-easy build, but it still looks clean and feels solid. The flight characteristics and EPO foam construction make this a very forgiving plane. If you are just learning how to fly and want to hone your skills or you just want something to toss in the air, not worry about, and have fun with, then the Funter is a great option for you. ±

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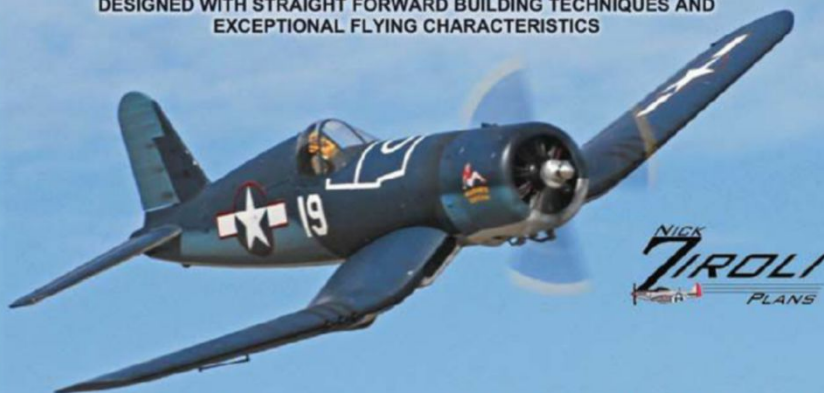
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E-flite/Horizon Hobby Valiant 1.3 BNF Basic

Classic looks with multifaceted performance

BY MICHAEL YORK PHOTOS BY JENNY & MICHAEL YORK



It's a nice day to fly, but you have limited room and can only take one plane. You feel like sport flying, but a buddy that wants to try RC is coming along. Oh, and there's a perfect pond to fly from right near the field. Decisions, decisions. Fear not—I have a plane for you that can fill all those needs. Feast your eyes on the Valiant 1.3m from E-flite. This multi-capable park flier is available in either Bind-N-Fly (BNF—this review) or Plug-N-Play (PNP).

Constructed out of reinforced Z-Foam, the Valiant 1.3m is designed to go together quickly and is ready to handle just about any type of flying you might be in the mood for. It shares the classic lines of its bigger brother, the Hangar 9 Valiant 30cc, but this scaled-down version is more portable and is perfect for those quick jaunts to the local park or small field.

Although it's called a "Basic" kit, it's not missing much to make it complete. All you need is a DSM2/DSMX-compatible transmitter, a 11.1V 3S 2200mAh 30C LiPo battery, and a charger and you're ready to go. The PNP version requires you to provide your own 6-channel receiver, and you lose the AS3X and Sensor



Quick battery changes are possible thanks to a simple latched cover. It also provides easy access to the gear screws, which allow a float swap in less than five minutes.



Assisted Flight Envelope (SAFE) features.

The in-depth multilingual instruction manual covers everything from the quick assembly to the various settings and features of the receiver's AS3X control system and SAFE Select Technology. If you have a usable pond or lake nearby, I consider the optional floats a must-have (see sidebar).

UNIQUE FEATURES

When you first open the box, it's obvious that the Valiant takes little time to put together. All

ONCE AIRBORNE, IT FEELS LIKE A MUCH BIGGER PLANE THANKS TO THE STABILITY SYSTEM, AND THE 480 MOTOR PROVIDES PLENTY OF OOMPH FOR NEARLY ANYTHING YOU WANT IT TO DO.



electronics are factory installed, and even the propeller has already been mounted. Everything is bolted together, so no adhesives are required. As always, the use of correct-size drivers will keep screw heads from wearing out. This is important if you swap frequently between the normal gear and floats.

The airframe is made out of light and durable Z-Foam, with strategic hard-plastic reinforcements. One of those is the battery/landing-gear compartment. There is plenty of room to allow some fore/aft adjustment of

the battery to fine-tune the center of gravity (helpful when switching between gear and floats). The alloy gear features preinstalled wheel pants that add a touch of class, and it does quite well on a mowed grass strip.

At the back end, the bolted-together tail feathers fit perfectly into molded alignment recesses, and the horizontal stab has a carbon spar to keep things from flexing too much. The bottom portion of the rudder hinge is screwed onto the fuselage, providing a strain relief from the tailwheel assembly.

AT A GLANCE



MODEL

Valiant 1.3m BNF Basic



MANUFACTURER

E-flite (e-fliterc.com)



DISTRIBUTOR

Horizon Hobby (horizonhobby.com)



WINGSPAN

53 in.



PILOT SKILL LEVEL

Intermediate



ASSEMBLY TIME

15 minutes



RADIO REQ'D

5-channel (DSM2/DSMX-compatible)



BATTERY REQ'D

11.1V 3S 2200mAh 30C LiPo



PRICE

\$199.99

WHAT WE LIKE

- + Classic looks
- + Minimal build time
- + Extremely versatile
- + Optional floats



GEAR USED

**RADIO**

Spektrum DX6 w/ AR636A (spektrumrc.com); SV80 servos (installed)

**MOTOR**

E-flite 960Kv 480 brushless outrunner w/ 30A Pro speed control (installed)

**PROP**

10.75x8 (installed)

**BATTERY**

E-flite 11.1V 3S 2200mAh 30C LiPo

The wings come in two pieces and are slid onto dual carbon spars. A plastic cap doubles as a wing connector and bolted-down retainer, which makes field assembly a snap, although the plane fits into most cars fully assembled. Preinstalled Y-connectors on the receiver and wing servo pigtails are well marked to prevent flap and aileron control mix-ups.

All the control surfaces have relatively large surfaces for the varying flight styles the Valiant is capable of, and they have a thin living hinge with tape reinforcement. This hinge style requires less effort from the servos, which

translates to crisp and accurate response and allows the AS3X to perform even better.

At the front end, the preinstalled 960Kv 480 brushless motor provides plenty of thrust for short takeoff and landing (STOL) performance.

Matching the classic lines is an equally classy-looking paint scheme. All the decals have been installed, and a black/white-striped-wing underside helps you tell which side is up when the plane is in the air.

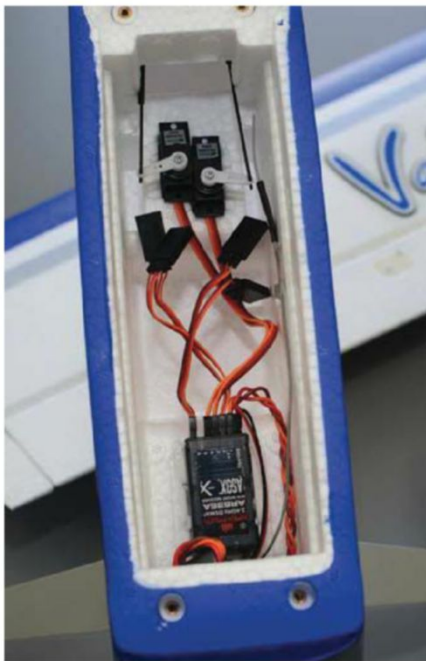
The Spektrum AR636A receiver, which comes installed in the BNF version, provides both AS3X stability and the amazing SAFE Select



The tail is bolted together with just three screws (two for the stabs and one for the lower rudder hinge). Snap on the control clevises and you're done. The tailwheel came preinstalled. You can also see the inlaid carbon spar, which adds rigidity.



The E-flite 960Kv 480 brushless motor comes installed with the propeller already mounted in place. There is more than ample airflow through the cowl, and large openings toward the rear of the fuselage keep everything cool.



This is how the fuselage comes out of the box—nothing to do but mount the wing. Note the brass inserts for the wing bolts. These will allow repeated wing removal for transport (if needed) without wearing out.

flight mode. This is a big reason the Valiant 1.3m can be enjoyed by anyone from advanced beginners to experts.

IN THE AIR

The Valiant 1.3m came in just a touch underweight and balanced perfectly with the recommended battery. The longish tail makes it a great ground handler, and the AS3X stabilization technology keeps everything lined up when heading down the runway, needing only minimal input from the rudder. Once airborne, it feels like a much bigger plane thanks to the stability system, and the 480 motor provides plenty of oomph for nearly anything you want it to do.

Flaps allow the Valiant to perform like a STOL plane, with takeoff rolls under full flaps being measured in inches rather than feet. With a bit of a breeze, it can actually land backward. Normal landings are easy, with just a bit of power needed for penetration if things aren't calm.

GENERAL FLIGHT PERFORMANCE

Stability: AS3X keeps things under control, but if you do have issues, SAFE is there to help you get control back.

Tracking: During both slow- and fast-speed flight, the Valiant does an excellent job in staying on the course you set.

Aerobatics: This is what makes this plane such a blast to fly. You can do just about everything, short of full-on 3D aerobatics. Rolls are surprisingly crisp, and there is plenty of power on tap for large maneuvers.



Just Floating Around

I consider the optional HobbyZone Super Cub Floats to be a must-have accessory if you have a usable body of water. (Don't let the name concern you—the floats are designed to fit the Valiant 1.3 perfectly.)

Construction is of the same Z-Foam as the plane, and they feature a thin plastic shell on the lower portion of the hull. This makes them glide better and more durable as well. At a mere 5.5 ounces, they won't weigh the plane down, although the added drag is noticeable during power-off flight. Assembly is quick and simple, and it takes less than five minutes to swap from wheels to floats.

The plane sits high in the water, and the stock motor and propeller are sufficient to get on step quickly. In the air, the Valiant handles the floats with ease, and you don't really notice them. Landings are easy, especially if you keep on a little power. Simply let the plane settle onto the water and pull the power. The wide stance of the floats makes it pretty hard to have a mishap, but if you do, the entire plane is made out of foam, so you don't have to worry about it going under. These floats add a whole new level of fun to the Valiant 1.3m, and if you've ever wanted to try flying off of water, this may well be the best combination.

Glide and stall performance: It's a light and clean airframe, so power-off performance is quite good. You really have to force a stall. If you do, it breaks straight ahead and recovers almost instantly.

PILOT DEBRIEFING

I had a chance to fly the Valiant 1.3m under a number of conditions, from calm mornings to gusty afternoons. It handled all with ease. AS3X does a fantastic job keeping the plane from being bounced around too much during gusty conditions, and it makes you look like a pro

during calmer weather.

For less advanced pilots, the switchable SAFE technology is a great safety net. It limits roll and pitch angles to keep things from getting out of hand, and if they do, simply let go of the controls and it will self-level. This is great for those who have friends who want to try out RC and a buddy box is not available.

For advanced pilots, the massive performance envelope keeps things interesting, both fast and slow. Flaps up allows for brisk and stable aerobatics, while full flaps will satisfy your short-field and slow-flight itch.

BOTTOM LINE

Quick building and easy setup minimizes box-to-smile time. E-flite has combined classic looks, durability, and a large performance envelope to create what just might be one of the best all-around park fliers I've seen, especially if you add the optional floats to the mix. It's one of those planes that will keep you coming back for more. ✚

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LENGTH: 18.2 in. (462mm)

FLYING WEIGHT: 3.7 oz (105 g)

RADIO: MLP6DSM with Spektrum™ DSMX® technology

MOTOR: 180 Brushless (installed)

BATTERY: 280mAh 2S 7.4V LiPo battery (included)

CHARGER: DC charger with AC adapter (included)



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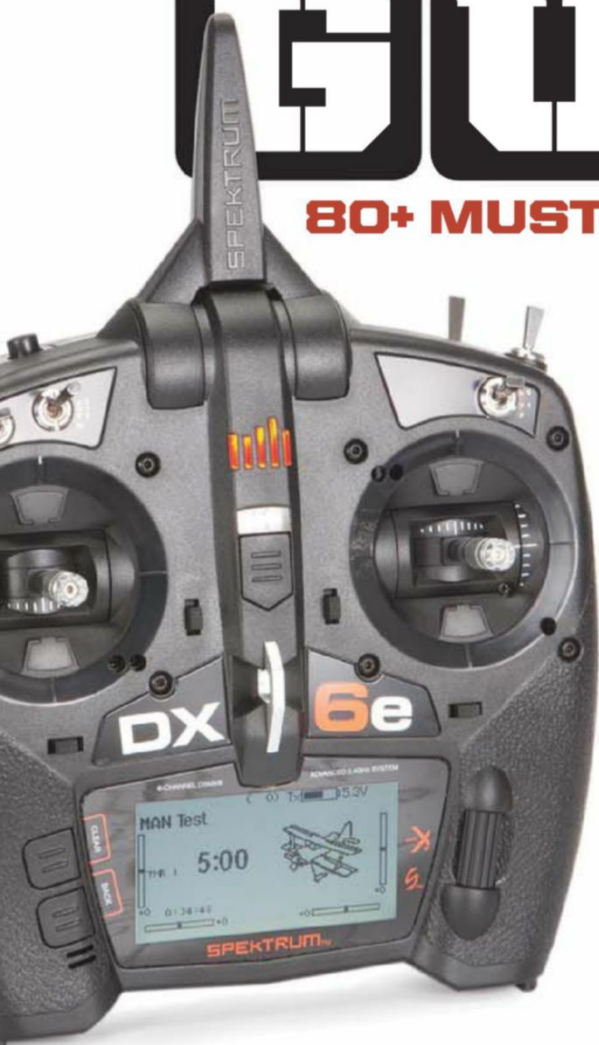
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We've collected all of these products into a concise, easy-to-use format to help you find the right gear, right now. The goal is to get you in the air faster and have more fun, so turn the page and let's get you geared up!



SPORT & TRAINER AIRPLANES

Dynam Primo 1450mm

Item no. DY8971P ➔ \$159

Motion RC and Dynam present the Dynam Primo with its giant tundra wheels. It's a great high-wing trainer molded after the super cubs the gifted bush pilots of Alaska might use when taking off and landing in less-than-ideal runways, which is a way of life there. Powered by a BM3720A3-KV650 brushless motor and 40-amp ESC, it packs a punch for a wide-range flight envelope yet offers outstanding slow-flight capabilities for those newer to the hobby.

motionrc.com/dynam



E-Flite Valiant 1.3m

Item no. EFL4950 ➔ \$200

Based on the popular 30cc ARF, this 1.3m park flier has the inherent stability of a classic high-wing model with more modern lines and a sporty response. It comes with functional flaps right out of the box, and you can also add optional floats. Constructed out of durable Z-Foam, the 53-inch-span Valiant 1.3m is powered by a 480-size brushless motor and a 30A ESC, and features a Spektrum AS3X receiver, with SAFE Select technology, and six micro servos all installed. Durable aluminum landing gear with wheel pants give it excellent ground handling. The recommended motor is a 1300-3000mAh 3-cell 11.1 volt battery (not included).

horizonhobby.com



Multiplex USA FunCub XL Kit and RR

Item nos. M214331 and M264331 ➔ \$210 (Kit) and \$420 (RR)

Just like its brother Cub, the FunCub XL features the same oversized control surfaces; loads of power; and precise, balanced handling for unlimited aerobatic flight. With a remarkably high-strength fuselage; two-piece wing; and big, soft tundra tires, the FunCub XL sets new standards in its class. Available exclusively at weekenderwarehouse.com in an airframe kit for you to assemble and equip or as an RR version that is nearly complete.

hitecrd.com



Multiplex USA ParkMaster Pro Kit and Kit Plus

Item nos. M214275 and M264275 ➔ \$90 and \$190

The lightweight and maneuverable MPX ParkMaster Pro is optimized for outdoor aerobatics and docile handling. It excels in confined spaces and is easily capable of torque rolls, rolling loops, and anything else you can throw at it! Available as a kit or a kit-plus version, which includes the brushless motor, speed control, propeller with driver, and Karbonite servos, the ParkMaster Pro may be your next favorite model!

hitecrd.com



Multiplex USA Rockstar Kit and RR

Item nos. M214278 and M264278 ➔ \$175 and \$330

Multiplex's flashy biplane, the Rockstar, with its efficient brushless motor, dependable preinstalled metal-gear Hitec servos, and chrome spinner, promises high-flying adventure. Choose the RR or kit version and you'll be having a blast rocking out impressive 3D maneuvers, wild torque rolls, dazzling spins, and inverted harriers. Wingspan: 41 in.; Overall length: 42 in.; Weight: 63 oz.

hitecrd.com

WE LIKE

Downsizing has made the Extra 330SC more affordable and more convenient but not any less capable as a 3D-aerobatic performer. We also appreciate both kit and flight-ready options, giving pilots the ability to select their own custom gear or get in the air quickly with a capable prebuilt package.



Multiplex USA Extra 330SC

Item nos. M214274 (kit) and M264274 (RR) ➔ \$220 (kit) and \$400 (RR)

Designed by World Champion pilot Gernot Bruckmann, the Extra 330SC is a smaller version of his award-winning aerobatic flier. Multiplex's M-frame technology and CFRP-based, two-part wing system make for an extremely rigid and stable airframe, suitable for performing the most dramatic 3D maneuvers. The impressive Extra 330SC is available as a kit and as an RR with two eye-catching color schemes. Length: 47.24 in.; Wingspan: 45.28 in.; Weight: 47.62 oz.

hitecrcd.com



Multiplex USA FunGlider

Item no. M264273 • \$171

The Multiplex FunGlider RR is an agile, electric sport glider designed for uplifting fun. Its robust ELAPOR foam construction, featuring M-Space technology, and a powerful brushless motor offer exciting aerobatics and thrilling slope and thermal soaring. Push the wings and tailplane into place and you are airborne-ready. This model will delight sailplane pilots from advanced beginners to experts. Length: 31.49 in.; Wingspan: 51.18 in.; Weight: 20.81 oz.

hitecrcd.com



WE LIKE

There's lots to like about the FunGlider, but at the top of the list are its excellent value (ready-to-fly with brushless power for less than \$175) and its construction, which maximizes strength without sacrificing performance-robbing weight. The result is a combo that soars and carves with the best in the class.



FlightLine RC F7F-3 Tigercat

Item no. FLW302P ⚡ \$349

Motion RC is proud to introduce the FlightLine RC F7F-3 Tigercat, the world's first mass-production foam electric RC Tigercat. Designed to incorporate EPO foam, wood, plastic, and carbon reinforcements, our design is easy to assemble and maintain, and delivers the strength and power to satisfy any RC airplane pilot. The aircraft features two 3748-600Kv brushless motors, two 3-blade 12x7 propellers (standard and reverse rotation), and two 60A ESCs.

motionrc.com/flightline



FlightLine RC F8F-1 Bearcat

Item no. FLW206P ⚡ \$199

FlightLine RC presents an exciting 1/9-scale flying electric replica of the F8F-1 Bearcat. This 1200mm EPO foam model assembles in minutes and features a scale profile, with many plastic detail parts. Scale power is provided by a 3748-580Kv brushless motor with a 4-blade scale propeller, and reaches speeds of 120kph/75mph level speed on a 4S battery. FlightLine RC's F8F Bearcat is a suitable aircraft for novice to advanced warbird pilots.

motionrc.com/flightline



Great Planes Zero GP/EP ARF Sport Fighter

Item no. GPMA1209 ⚡ \$150

This 56.5-inch-span Sport Fighter version gets you to the flightline faster than with any kit. Once there, it is an easy flier for anyone transitioning from a high-wing trainer; it's also a plane that can "tear up the sky" doing aerobatics. Its large magnetically attached hatch makes accessing onboard gear and LiPo batteries quick and easy. It includes parts for brushless and glow power setups.

greatplanes.com



Rage R/C Spirit of St. Louis Micro RTF

Item no. RGRA1100 ⚡ \$100

The *Spirit of St. Louis* is a fully assembled RTF (ready-to-fly) with a 22-inch wingspan and a flight-ready weight of 41g. In addition to the scale airframe with installed 3-in-1 control board, the 2.4GHz transmitter conveniently charges the included 1S 150mAh LiPo battery. Even the AA batteries needed to power up the transmitter are included, so you can fly this amazingly detailed historic airplane within minutes of opening the box!

ragerc.com

**Tower Hobbies P-51 Mustang
Silver Rx-R 40-Inch**

Item no. TOWA2012 ➔ \$120

Tower Hobbies' P-51D Mustang goes together quickly and easily, looks like the real thing, and flies like it's on rails. The motor, ESC, and servos are already in place—all you have to supply is your radio system and battery. And it's made out of AeroCell foam, so it repairs easily with CA adhesive. It's loaded with iconic Mustang details, like molded exhaust stacks, panel lines, machine guns, an instrument panel, and a painted and installed pilot bust.

towerhobbies.com**WE LIKE**

There's nothing quite like a P-51 Mustang. The combination of looks and performance is a recipe for thrills; no true warbird enthusiast should be without a Mustang. The Tower Hobbies 40-inch P-51 deserves a place in your stable with all its scale details, and the easy-fix construction means you don't have to baby it—you can fly it like a Mustang was meant to be flown!

Freewing A-10 Thunderbolt II 80mm

Item no. FJ31111P ➔ \$549

Motion RC and Freewing Models present the world's largest and most definitive foam electric PNP A-10 Thunderbolt II RC model aircraft. Powered by twin 80mm EDFs, this 1700mm plane is still easy to transport. The Freewing 80mm A-10 was specifically designed to be the most grass-capable PNP EDF on the market. While sporting a scale Oleo nose strut, the main struts are tensioned trailing links for grass up to 3 inches long.

motionrc.com/freewing



Freewing F-16 V2 6S V2 70mm

Item no. FJ2111P ➔ \$229

This is a completely updated and redesigned F-16 modeled in EPO foam, with a 70mm 12-blade EDF and 3048-2300Kv power system included. With its 1306mm length and 878mm wingspan, this 1/12-scale flying replica includes many exciting features. Removable main wings and a magnetic nose cone make transport very convenient. A control board consolidates the wiring for a clean battery bay. The top speed exceeds 100mph with the stock 6S setup.

motionrc.com/freewing



Freewing F-22 Raptor 64mm

Item no. FJ10512P ➔ \$139

Motion RC and Freewing bring you the Freewing F-22 Raptor 64mm. Quality electronic components come preinstalled, so you can be in the air in less than one hour. The F-22 also includes an upgraded 3300Kv motor, 12-blade fans, 40A ESC, and 4S LiPo capability, making it the perfect EDF jet for those pilots seeking higher top-end speeds and faster climbing rates. The main wing, rudder, and elevators are detachable, making for easy transport and repair.

motionrc.com/freewing



Freewing MiG-21 80mm

Item no. FJ21021P ➔ \$329

Dominate the skies with Freewing's 1/9-scale MiG-21! The jet's impressive 1730mm length puts the aircraft into a category all its own. It includes removable wings and horizontal and vertical stabilizers for easy transport to the field. It comes with an 80mm 12-blade EDF, an all-new 3530-1800Kv outrunner motor, a 100A ESC, and digital metal-gear servos controlling the ailerons, flaps, elevators, and rudder. It takes off in less than 100 feet.

motionrc.com/freewing

Freewing Avanti S 80mm

Item no. FJ21211P ➔ \$299

The Avanti's remarkable performance and crisp handling at all speeds sets it apart as one of the most sought-after sport jets in the hobby. It includes a powerful 12-blade EDF with all-new 3530-1800Kv outrunner motor and a 100A ESC capable of 115mph with a 4000mAh 6S battery. It has removable wings, with quick disconnect plugs and electronic retracts and trailing link suspension.

motionrc.com/freewing



Skymaster USA Skymaster Jets

Item no. N/A ➔ Call for packages and upgrade pricing

Skymaster PRO ARF Plus and Xtreme ARFs feature scale details not found on other models, with many full-scale schemes available. SkyMaster develops some of the finest turbine jet products in the world. Airframes are hand-built in molds, and the all-composite structures are the strongest and lightest available. Save on shipping with container preorders.

chiefaircraft.com



GIANT-SCALE AIRPLANES

Hangar 9 Ultra Stick 30cc

Item no. HAN2365 • \$300

Based on the popular Ultra Stick well known for its versatility, this 30cc-powered flier blends sport-flying fun with superbly crafted ARF construction. Featuring flaps for an expanded flight envelope, it comes covered in UltraCote and has large double-beveled control surfaces for excellent control response. Its two-piece plug-in wings make transport easy, and the sturdy aluminum wing tube provides additional strength. It comes ready to install the Evolution 336X gas engine.

Horizonhobby.com



Pilot RC Balsa Airplanes

Item no. N/A • \$419 to \$1,599

Pilot RC manufactures the highest-quality balsa planes. No corners are cut when building any of its planes, from 24% up to 55%. Models available include the New Extra 330LX and Edge V3 airframes, plus the YAK 54, YAK M55, Sbach 342, Edge 540, Extra 330SC, Decathlon, and 3D Trainers. Chief Aircraft features many exclusive schemes, or you can order your own custom scheme. Professional building services are also available for the pilot on the go.

chiefaircraft.com



RCGuys.com Cessna 150 Aerobat ARF

Item no. RC-3303 • \$519

This large-scale, all-wood, laser-cut ARF is brilliantly covered and includes a full hardware package, painted fiberglass cowl and wheel pants, scale hinged pilot side door, working flaps, a corrugated finish on all control surfaces, and a two-piece wing with aluminum wing tubes. Wingspan: 96 in.; Weight: 12 to 14 lb.; Engine required: .90 to 1.2 two-stroke, 1.2 to 1.8 four-stroke, or 20 to 32cc gas; Radio required: 5-channel with seven servos.

rcguys.com

Krill Models Ultimate 300KS

Item no. KRM-ULT39 • \$2,150; 120cc DA combo, \$3,421

With the new Digital Schemes in stock, the Krill 39 Ultimate 300KS ARF features a 92-in. wingspan for 120cc power. Developed in cooperation with SebArt, the kit is designed for pattern and 3D aerobatics. Slim wings with a unique thin sharp airfoil allow a dry weight about 33 lb. It features stainless-steel tube cabanes and carbon-fiber interplane struts with no additional flying wires required.

chiefaircraft.com



RCGuys.com Cessna 188 Ag Wagon ARF

Item no. RC-3309 • \$499

This large-scale, all-wood, laser-cut ARF is brilliantly covered and includes a full hardware package, painted fiberglass cowl, large-scale canopy for easy internal access, working flaps, corrugated finish on all control surfaces, and a two-piece wing with aluminum wing tube. Wingspan: 98 in.; Weight: 13 to 16 lb.; Engine required: .90 to 1.60 two-stroke, 1.20 to 2.70 four-stroke, or 23 to 40cc gas; Radio required: 5-channel with seven servos.

rcguys.com

Amimon Falcore

Item no. AMN800101 ➔ \$799

The Falcore is a FPV racing drone designed from the ground up to help expose drone racing to everyone. It allows novice pilots to fly and race right out of the box, and with a switch of a button, the Falcore turns into an aggressive, ultra-fast, ultra-durable racing drone.

amimon.com



Amimon Connex Mini

Item no. AMN1811PB_01 ➔ \$1,299

The Connex Mini is a new zero-latency, wireless, compact HD video-transmission system. The new Mini is specifically designed for aerial video-production applications that can be used on drones that have a limited payload. Despite its small size, it delivers performance that includes full 1080p HD video at 60 frames per second, with zero latency at up to a range of 1,600 feet. This unit is well worth a look.

connex.amimon.com



Amimon Connex ProSight

Item no. AMN7000_PB_01 ➔ \$499

The Connex ProSight 720p HD camera, transmitter, and ground unit is an advanced digital FPV system designed for racing. The required camera can be used for both indoor and outdoor flying. This system supports line-of-sight transmission of up to 3,000 feet. The pilot can choose from 27 digital channels, which makes it easy to use when racing against other pilots. The system features an HDMI output and is compatible with most popular HDMI-based goggles/monitors.

connex.amimon.com



Blade Torrent 110 FPV BNF Basic

Item no. BLH04050 ➔ \$200

The Torrent 110 FPV Racing Drone is a good choice for beginners and advanced racers alike. This micro quad features a carbon-fiber frame for durability and a 150mW video transmitter for clean video in any flight environment. The built-in 600TVL camera has a 120-degree field of view, and the Betaflight flight controller offers easy tuning. The Spektrum Telemetry Serial receiver gives valuable flight-log feedback straight to the transmitter.

horizonhobby.com



RISE Vusion Extreme FPV Racing Quad Race Pack RTF

Item no. RISE0200 ➔ \$350

The revolutionary Vusion 250 Extreme FPV Race Pack blends innovation and convenience with the ultimate FPV racing drone. It's the first—and only— injection-molded RTF 250-size racing drone to come with all essential FPV equipment installed. Everything's designed to work seamlessly together, for the ultimate flying experience! A micro memory card slot makes it possible to transfer flying footage from the onboard 600TVL FPV camera.

explore-rise.com

ENGINES & AIRPLANE ACCESSORIES

MVVS Engines Gas Engines

Item no. N/A ➔ **Call for pricing**
MVVS has been making solid, reliable, and powerful engines since 1953. With multiple world championship titles under its belt, you can be sure the engines are worth every penny—and more. They are suitable for all kinds of models, including acrobatics, F3D, or whatever flying style you prefer. They are also easy to use, which makes them suitable for beginners.
chiefaircraft.com



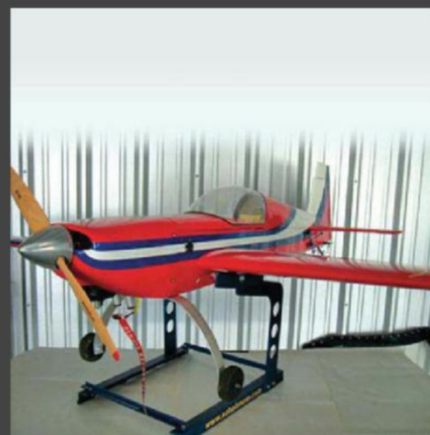
Southwest Systems EZ Balancer "Lite"

Item no. EZ Balancer "Lite" ➔ **\$86**
This "hands-free" balancer features exclusive cradle limiters and is made out of aircraft-grade aluminum, so it is built to last. Strong aluminum cradles with rubber guards protect your model without breaking the structure of the wing. The balancer is adjustable in width to 11 1/2 inches and is powder-coated to stay good-looking for a long time. It handles models up to 20 lb., and you can store it flat to save space.
ezbalancer.com



Southwest Systems EZ Balancer II

Item no. EZ Balancer II ➔ **\$230**
This "hands-free" balancer features exclusive cradle limiters and is made out of aircraft-grade aluminum, so it is built to last. Strong aluminum cradles with rubber guards protect your model without breaking the structure of the wing. The balancer is adjustable in width to 18 inches, is powder-coated to stay good-looking for a long time, and has the highest capacity of any balancer on the market.
ezbalancer.com



Sullivan Clevises and Ball Links

Item nos. vary ➔ **Prices vary**
Sullivan's Control System Components are constructed and engineered to be among the strongest and best in the world. The Gold-N-Clevises are made out of spring steel with a welded center pin, and are brass-plated (for easy soldering) with a unique steel retaining clip; they're available in 2-56 and 4-40 sizes. Machined-aluminum hard-coat-anodized ball links permit easy-off axis operation, allowing for precise adjustment; they're available in 2mm, 3mm, 2-56, and 4-40 sizes.
sullivanproducts.com



Sullivan Gold-N-Rods and Cables

Item nos. vary ➔ **Prices vary**
Sullivan's Gold-N-Rods use premium resins to ensure smooth operation and to decrease thermal expansion. Manufactured to tight tolerances, Gold-N-Rods are flexible for life and can be used in many applications. Sullivan's stranded stainless-steel cables combine high strength with great flexibility. They are plated for easy soldering. Sullivan packages its Gold-N-Rods and steel cables with Gold-N-Clevises, and they come in many popular sizes.
sullivanproducts.com



Sullivan SkySmoke Smoke Fluid

Item nos. S760 and S761 ➔ **Prices vary**
Sullivan's SkySmoke Smoke Fluid offers full-scale smoke for your RC plane. SkySmoke is 100 percent paraffinic oil with no additives, making it safe for all RC materials, including glue, foams, and iron-on coverings, and it is also safe in turbine engines. This environmentally safe oil produces bright white billowing smoke. Perfect to use with the S753 Sullivan SkyWriter! Available in 10-gallon (S760) and 5-gallon (S761) containers.
sullivanproducts.com

Sullivan SkyWriter Smoke System

Item nos. **\$752, \$753, and \$754** Prices vary Sullivan's SkyWriter Onboard Smoke System uses an internal microprocessor, allowing the smoke rate to be proportionally controlled from your transmitter while slaved to your throttle during flight. The SkyWriter weighs less than 4 oz., operates on any 4.8-12V battery, and includes all fittings and tubing required. The Streamer Smoke Oil and Glow Fuel field-box pumps feature ultrasonically welded pumps and three-position switches, and are rated at 33 oz./minute.

sullivanproducts.com



Warbird Pilots Highly Detailed Scale Pilot Figures

Item nos. vary \$65 and up

Warbird Pilots offers a full line of highly detailed 1/8-, 1/7-, 1/6-, 1/5-, 1/4-, and (all-new) 1/3-scale WW I, WW II, civilian, and jet-pilot figures for your scale aircraft. More than 50 different figures available. A wire-frame cotton-filled body keeps them incredibly light, and they can be put into any position. An adjustable seated height accommodates any cockpit. Pilots are outfitted with scale accessories, making them perfect for your scale project.

warbirdpilots.com

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GLOSSARY OF AVIATION TERMS

ABC: Term that refers to the materials used in the engine. An ABC engine is one with an aluminum (A) piston that's fitted inside a brass (B) sleeve that's chrome (C) plated.

Adverse yaw: Yaw generated when the ailerons are used. The lifting wing generates more drag, causing an airplane to yaw (turn) out of the turn.

Aileron: Roll control surface.

Ampere (amp) (A): Standard unit of electric current.

AoA (angle of attack): Angle difference between the wing chord line and the relative wind.

Base leg: Portion of the landing pattern 90 degrees to the final approach.

Battery eliminator circuit (BEC): Circuitry that allows the battery that runs the motor to also power the receiver and the servos.

Brushed motor: Older, traditional type of electric motor where brushes make contact between the rotor and the stator.

Brushless motor: Popular electric motor now used to power RC electric aircraft. More powerful than traditional brushed motors.

Capacity: Measure of how long you can draw a specified current from a battery. Measured in amp hours (Ah) or, more commonly for the scale of equipment used for electric flight, in milliamp hours (mAh).

Climbout: Gain in altitude after takeoff.

Con rod: Short for "connecting rod." Connects the piston to the crankshaft.

Crosswind leg: Portion of the traffic pattern that's 90 degrees to the runway and directly opposite of the base leg.

Current: Flow rate of electrical energy measured in amps.

Dihedral: Upward angle of the two wing panels relative to the fuselage. Contributes to the model's roll stability.

Doublers: Items glued to the inside of the fuselage sides to add strength in specific, high-stress areas.

Downwind leg: Portion of the traffic pattern that is flown in the opposite direction of the wind. The downwind leg is directly opposite the upwind leg and parallel to the runway.

Drag: Force that acts to slow down the airplane.

Elevator: Pitch control surface.

Engine case: Main body of the engine.

Gravity (G-force): Force that pulls down on the model, measured in Gs or G-forces.

Final approach: Upwind portion of landing pattern after base leg and just before flare and landing.

Firewall: Engine is attached to this part, and sometimes the model's nosewheel is also secured to it.

Flare: Gradual increase in pitch angle to bleed off excess airspeed just before landing.

Formers: Internal vertical structures that support the sides and give the fuselage its strength and rigidity.

Fuel mixture: Mixture of air and fuel drawn into the engine through the carburetor.

Fuselage: Main body of the airplane. All the other parts and components are attached to it. The fuselage houses most of the airborne radio equipment and the powerplant.

Head: Part on top of the engine that is usually bolted in place. At its center is a threaded hole for the glow plug.

Heading: Actual direction the model travels over the ground, not the direction the model is pointing.

Horsepower (hp): Measure of the rate of work—33,000 pounds lifted one foot in one minute, or 550 pounds lifted one foot in one second. Exactly 746 watts of electrical power equals one horsepower.

Leading edge (LE): Very front edge of the wing. It is rounded to allow the air to flow easily over both the top and bottom surfaces.

Lift: The force exerted on the top of a moving airfoil as a low-pressure area, which causes a wing to rise.

LiPo: Term that stands for "lithium-ion polymer." The most modern kind of battery pack that's used in electric aircraft.

Longeron: Long, sticklike part that runs from nose to tail. It supports and strengthens the fuselage structure.

mAh (milliamp hour): Measure of a battery's total capacity. The higher the number, the more charge a battery can hold and, usually, the longer a battery will last under a certain load.

Main spar: Part that gives the wing its longitudinal strength. It runs from the wing root (middle of the wing) all the way to the tip.

Ni-Cd: Abbreviation for nickel-cadmium battery cells.

NiMH: Abbreviation for nickel-metal-hydrate battery cells.

Pitch: One of the three axes in flight, this specifies the vertical action or the up-and-down movement.

Port: Channel or opening inside the engine that guides and transfers the fuel and air mixture from the crankcase to the combustion chamber. Opened and closed by the piston's up-and-down motion.

Power: For electric models, this is a product of voltage and amps, and it is measured in watts.

Rib: Part that gives the wing its cross-section shape; the shape is also known as an "airfoil." It is this shape that generates the lifting force that allows airplanes to fly.

Roll: One of the three axes in flight, this specifies the action around a central point.

rpm (revolutions per minute): The number of times an object completely rotates (360 degrees) in one minute.

Rudder: Part that controls the model's yaw (nose-left and nose-right movement). Deflecting the rudder swings the nose left or right while in flight. Rudder input also steers the model on the ground while taxiing and is used to correct a flight condition known as "adverse yaw."

Sleeve: Inside cylinder lining that houses and guides the piston. It is a separate piece from the engine case and has openings or ports cut into its side. There are some engine designs that do not have a separate sleeve.

Stall: Sudden loss of lift when the angle of attack increases to a point where the flow of air breaks away from a wing or airfoil, causing it to drop.

Stringer: Similar to a longeron but is typically small and used to support the model's covering, which gives the fuselage its shape.

Taxi: Travel across the ground.

Thrust: Force that pulls (or pushes) a model forward. Thrust is created by the propeller as the engine or motor spins it. A propeller has an airfoil-shaped cross-section.

Torque: Twisting force created by the engine spinning a propeller. The force acts in the opposite direction of the rotating propeller.

Trail edge (TE): The tapered, most aft edge of the wing. More sharply and smaller than the LE to help the air passing over and under the wing to come back together with a minimum of drag or turbulence.

Trim: Secondary transmitter controls to adjust the amount of rudder, elevator, and throttle.

Upwind leg: Portion of the traffic pattern that is flown into the wind.

The upwind leg is directly opposite the downwind leg and parallel to the runway.

Voltage (V): Unit of electromotive force that, when applied to conductors, will produce current in the conductors.

Watt (W): The amount of power required to maintain a current of 1 ampere, at a pressure of one volt, when the two are in phase with each other. One horsepower is equal to 746 watts. Watts are the product of volts and amps.

Wing: Part that produces lift. It consists of several parts and subassemblies.

Wing saddle: Part of the fuselage that the wing rests upon. The wing saddle is usually also the main opening for access to the radio equipment.

Wingtip: Part at the very end of the wing panel. Mostly cosmetic.

Yaw: One of the three axes in flight, this specifies the side-to-side movement of an aircraft on its vertical axis, as in skewing.

RADIO TRANSMITTERS

Detrum Gavin-6C Transmitter

Item no. DY-DTM-T004 ➔ \$80

The new line of Detrum transmitters offers impressive cost savings without compromising quality and features. This 6-channel radio is a perfect starting point for most beginner and intermediate pilots. Suitable for airplanes, helicopters, and multirotors, the transmitter stores 30 models in its memory. It uses 2.4GHz technology, which allows a strong anti-interference capability.

motionrc.com/radios



Hitec RCD USA Flash 7 and 8

Item nos. vary ➔ \$150 to \$165 (Flash 7); \$200 to \$230 (Flash 8)

Featuring G2 Adaptive Frequency Hopping Spread Spectrum and Secure Link Technologies, the Flash 7-channel and Flash 8-channel radios, with advanced programming and rock-solid signal strength, are the ideal choice for all levels of discerning pilots. Each boasts a high-resolution graphic screen providing easy-to-read, easy-to-navigate operation for all your flying needs. Take to the air in a Flash!

hitecrcd.com



Jeti USA Duplex Radio Systems

Item nos. N/A ➔ Starting at \$695; receivers from \$69

Jeti radios and duplex receiver systems are state of the art and set new standards for the RC industry. The attention to detail and finishes are outstanding, from the carbon-fiber front panel to the anodized CNC aluminum case. Upgradable firmware gives you full freedom and complete control to customize your radio for your needs, with built-in telemetry on all models.

chiefaircraft.com



Spektrum DX6e 6-Channel DSMX (transmitter only)

Item no. SPMR6650 ➔ \$150

The DX6e 6-channel radio provides four model types: heli, multirotor, airplane, and sailplane programming. It has 250-model memory as well as a wireless trainer link. It's telemetry capable and provides programming for more than 20 wing, tail, and swashplate types. It has a multirotor flight-mode setup, 7-point throttle curves, and 7-point heli pitch and tail curves, and it supports cross-platform model sharing with other Spektrum radios.

horizonhobby.com



Tactic TTX850

Item no. TACJ2850 ➔ \$180

Choose the TTX850 radio system for computer sophistication, performance, and programming ease. Its software has features for virtually any aircraft, from airplanes and helis to multirotors. Adding that to its wealth of functions and generous memory, the TTX850 could easily be the only radio you need to fly an entire hangar full of aircraft. Push buttons and intuitive menus combine for fast, easy programming.

tacticrc.com

SERVO S & RADIO ACCESSORIES

Hitec RCD USA D625MW and D645MW

Item nos. 36625 and 36645 ➔ \$40

These durable metal-gear servos are part of the Hitec D-Series, which combine industry-leading high-resolution, ultra-response technology with a 32-bit MCU and 12-bit ADC for unprecedented programmability and flexibility. These speedy, powerful servos operate on a wide 4.8-8.4 voltage range, allowing use with any common battery chemistry without the need for adapters or regulators. Outperform the competition with these metal-gear dynamos!

hitecrd.com



Hitec RCD USA D840WP and D845WP

Item nos. 36840 and 36845 ➔ \$100

These steel mega-scale waterproof servos are part of the D-Series dynamo line. Combining industry-leading high-resolution, state-of-the-art ultra-response technology with a 32-bit MCU and 12-bit ADC for unprecedented programmability and flexibility, these servos deliver significantly smoother movement. Operating on a wide 4.8-8.4 voltage range and featuring an IP-67 rating, this duo is a mega hit!

hitecrd.com



Hitec RCD USA D940TW, D945TW, D950TW, and D980TW

Item nos. 36940, 36945, 36950, and 36980 ➔ \$148 to \$170

These titanium-gear titans will take your aircraft to a whole new performance level. The D-Series of servos combines industry-leading high-resolution, ultra-response technology with a 32-bit MCU and 12-bit ADC for unprecedented programmability and flexibility. With a wide 4.8-8.4 voltage range, these impressive servos allow use with any common battery chemistry—no need for adapters or regulators.

hitecrd.com



Hitec RCD USA D941TW, D946TW, and D951TW

Item nos. 36941, 36946, and 36951 ➔ \$158

Powered by a 32-bit MCU and 12-bit ADC industrial science, these D-series servos' potent combination of wide voltage capabilities, high resolution, rapid response, and Smart Sense technology deliver maximum performance. Designed with full-metal cases, these servos bring the ultimate in reliability and advanced engineering to your hobby projects.

hitecrd.com

Hitec RCD USA HS-35HD and HS-5035HD

Item nos. 33035S and 35035S ➔ \$25 to \$31

These small servos deliver big. They offer unprecedented durability in both an analog and a digital version, and are perfect for micro 3D, sport aircraft, and small helicopters. Specs for both at 4.8 volts—Torque: 11.2 oz.-in. at 0.12 sec.; Weight: 0.16 oz.; Dimensions: 0.74 x 0.30 x 0.62 in.

hitecrd.com



Hitec RCD USA HS-53 Premier Feather

Item no. 31053S ➔ \$8

The HS-53 is an economical feather servo designed to compete head to head with the influx of low-cost servos. Designed with a durable nylon gear train and an efficient three-pole cored motor, this lightweight servo is a terrific fit for small power planes and gliders. Specs at 6.0 volts—Torque: 21 oz.-in. at 0.13 sec.; Weight: 0.28 oz.; Dimensions: 1.12 x 0.46 x 0.95 in.

hitecrd.com



SERVO & RADIO ACCESSORIES

Hitec RCD USA HS-65MG and HS-5065MG

Item nos. 32065S and 35065S ➔ \$25 to \$31
These feather mini servos deliver strong performance in a compact package. The HS-65MG and HS-5065MG boast metal gears with 31 oz.-in. torque at 6 volts. Both weigh in at a mere 0.42 oz. and measure 0.92 x 0.45 x 0.94 in. Mighty feather minis!
hitecrd.com



Hitec RCD USA HS-70MG and HS-5070MH

Item nos. 32070 and 35070 ➔ \$32 to \$37
The HS-70MG and HS-5070MH ultra-torque feather servos deliver outstandingly strong performance to all your micro and mini fliers. Designed with Hitec's durable metal gears, both the analog and digital versions may become your favorite "go-to" servos. Specs for HS-70MG at 6.0V—Speed: 0.14 sec.; Torque: 42 oz.-in. Specs for HS-5070MH at 7.4V—Speed: 0.12 sec.; Torque: 53 oz.-in. Specs for both—Weight: 0.50 oz.; Dimensions: 0.92 x 0.45 x 1.14 in.
hitecrd.com



Hitec RCD USA HSB-9360TH, HSB-9370TH, and HSB-9380TH

Item nos. 39363, 39373, and 39383 ➔ \$180
With ultra-efficient brushless motors, low current consumption, and constant output power, the 93xx series of servos is the perfect match for the most discriminating pilots. The 9360's speed is ideal for helicopter pilots. The 9370's speed and torque combination make it a great general-purpose servo. The 9380's torque makes it the power solution for all giant-scale pilots.
hitecrd.com



Hitec RCD USA HSB-9465SH, HSB-9475SH, and HSB-9485SH

Item nos. 39466, 39476, and 39486 ➔ \$100
Ideal for giant-scale aircraft and 700-size helicopters, these servos deliver the power and precision that pro-level hobbyists need. All have Hitec's durable steel gears and impressive brushless motors. The 9465 brings lightning speed, the 9475 delivers multipurpose performance, and the 9485 has the ultra torque necessary for the most demanding applications.
hitecrd.com



HobbyEagle A3-L 3-Axis Airplane Gyro

Item no. HEA3LITE ➔ \$23
This gyro is the new, upgraded version of the top-selling Eagle Pro SE. It is a significant upgrade over the previous-generation A3 Pro. Major updates include a new protective shell, updated v2.7 logic software, remote master gain control, and automatic gyro calibration at start-up. It works with all major receiver brands, including Spektrum, Futaba, Hitec, JR, Tactic, and more.
motionrc.com/gyro

BATTERIES, CHARGERS & POWER SUPPLIES

Admiral 6S 5000mAh 22.2V 50C Battery

Item no. **EPR50006** ➔ \$109

Motion RC has released its new and updated Admiral 6S 5000mAh battery. This new pack is designed to extract the maximum performance from your planes. Extensive RGD and testing ensure confidence that these batteries will produce great results for you. The battery includes an EC5 connector as well as a JST/HX balancing connector, the most common balance plug on the market. It has a discharge rate of 50C.

motionrc.com/admiral



Bat-Safe

Item no. **N/A** ➔ \$59

This LiPo-battery-charging container has double-wall construction and features fireproof seals and filters to keep you safe should something unforeseen happen while charging your battery pack. Including a cloth carry strap and a metal charger attachment bracket, the Bat-Safe can fit and be used to charge and store up to 12S 5Ah packs. A spring-loaded latch secures the lid for an airtight seal. The Bat-Safe is a great insurance policy against faulty battery packs, which could cause damage when you least expect it.

bat-safe.com



Hitec RCD USA X1 Nano Charger

Item no. **44253** ➔ \$25

The X1 Nano is the economical battery-charging companion for all hobbyists. Simply plug in the AC power cord to a standard 100-240V outlet and you are ready to successfully charge all popular battery chemistries in a snap. With a charge circuit power of 50 watts, this mini charging unit is easy to operate, compact, and efficient. Select your battery type and choose from four charge current settings with the press of a button.

hitecrd.com



Hitec RCD USA X4 AC Pro Charger

Item no. **44254** ➔ \$200

The X4 AC Pro is a high-performance charger/discharger with extensive battery-management capabilities. Capable of operating on 100-240V of AC household current or from an 11-18V DC power source, this powerhouse exudes a total charge circuit power of 200 watts, with power-distribution capability in AC mode and a 300-watt output when in DC mode. Connect up to four batteries of varying chemistries with each channel performing independently.

hitecrd.com



Racer's Edge Ultra 120 Touch AC/DC Charger

Item no. **RCE2855** ➔ \$170

This fully featured, AC/DC touchscreen charger serves the needs of racers and pilots alike. The screen and user interface is optimized for convenience and ease of use, while a new 16-bit CPU has been developed to safely and accurately charge LiPo, LiFe, Li-Ion, LiHV, Ni-Cd, NiMH, and Pb batteries at a maximum rate of 12A, with automatic protection against reverse polarity input or output.

racers-edge.com

ELECTRIC POWER SYSTEMS & ACCESSORIES

Hitec RCD USA Energy Sport ESCs

Item nos. 59046 to 59050 ➔ \$16 to \$60

Designed specifically for the sport flier, Hitec's Energy Sport speed controls deliver the reliability and performance your hobby demands! These economically priced ESCs come prewired with standard motor and battery connectors, and are available in several sizes to accommodate a wide variety of models.

hitecrnd.com



ZTW Mantis 65A ESC w/ 5A SBEC

Item no. ZTW2065201 ➔ \$38

The ZTW Mantis series is designed as a performance upgrade for your stock/OEM ESC. It features compact size, light weight, simplified PCB design, super-smooth start-up and throttle linearity, multiple circuit protections, governor, high-amp BEC output, and more. It supports high-rpm motors, so it can be used with most RC motors, and it has an advanced governor mode. It comes with a preinstalled T-connector and 3.5mm bullets for your convenience.

motionrc.com/collections/ztw



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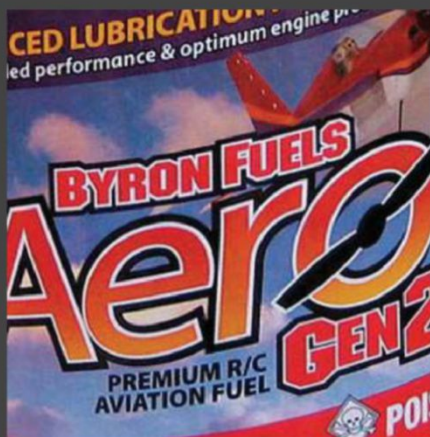
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byronfuels.com



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Zap Glue Formula 560

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This multi-use product is white in color but cures clear. It's terrific for fastening canopies to airframes; for use as a hinge glue; and anywhere a flexible, strong adhesive is required. You can even clean it up with water until it has cured. zapglue.com



Zap Glue Slo-Zap

Item nos. vary ➤ Prices vary

This thick formula is one of the strongest CA glues out there. It works well on hard woods, metals, and ceramics, and the slow cure offers extra time for positioning parts. Slo-Zap cures in 30 to 60 seconds and is available in two sizes. zapglue.com



Zap Glue Zap Z-Poxy

Item nos. vary ➤ Prices vary

Zap's Z-Poxy comes in four different formulas: 5-Minute Cure, 15-Minute Cure, 30-Minute Cure, and even a Finishing Resin, which just happens to be an ideal product for adhering fiberglass cloth to a structure. All are equal-mix formulas with noncritical measurement requirements. zapglue.com

HOW TO

The Language of Aerobatics

LEARNING TO READ AND INTERPRET
ARESTI DIAGRAMMS

BY JOHN REID

Learning aerobatics takes many hours of practice and many gallons of fuel, but in addition to flying, you will also have to learn a new language called "Aresti." This language consists of simple drawings that make it easy for pilots of full-size aerobats to glance at and move on to the next maneuver. For pilots of RC aerobats, Aresti diagrams allow us to comprehend the maneuvers and keep them in order throughout the sequence. Understanding and reading Aresti diagrams will make it easier for you to follow the sequence and make you a valuable caller (a spotter who calls out each maneuver for the pilot to help guide him or her through the sequence).



MAKING ARESTI EASY

Take a look at diagram below, which is the 2017 official basic known sequence for the International Miniature Aerobatic Club. If this is your first time looking at an Aresti diagram, it might be a bit intimidating and confusing. So let's start by looking at the basic parts of the diagram first and then putting them together.

The solid black line represents the line of flight and, in this case, means upright flight.

A dashed line (usually in red) represents and inverted line of flight.

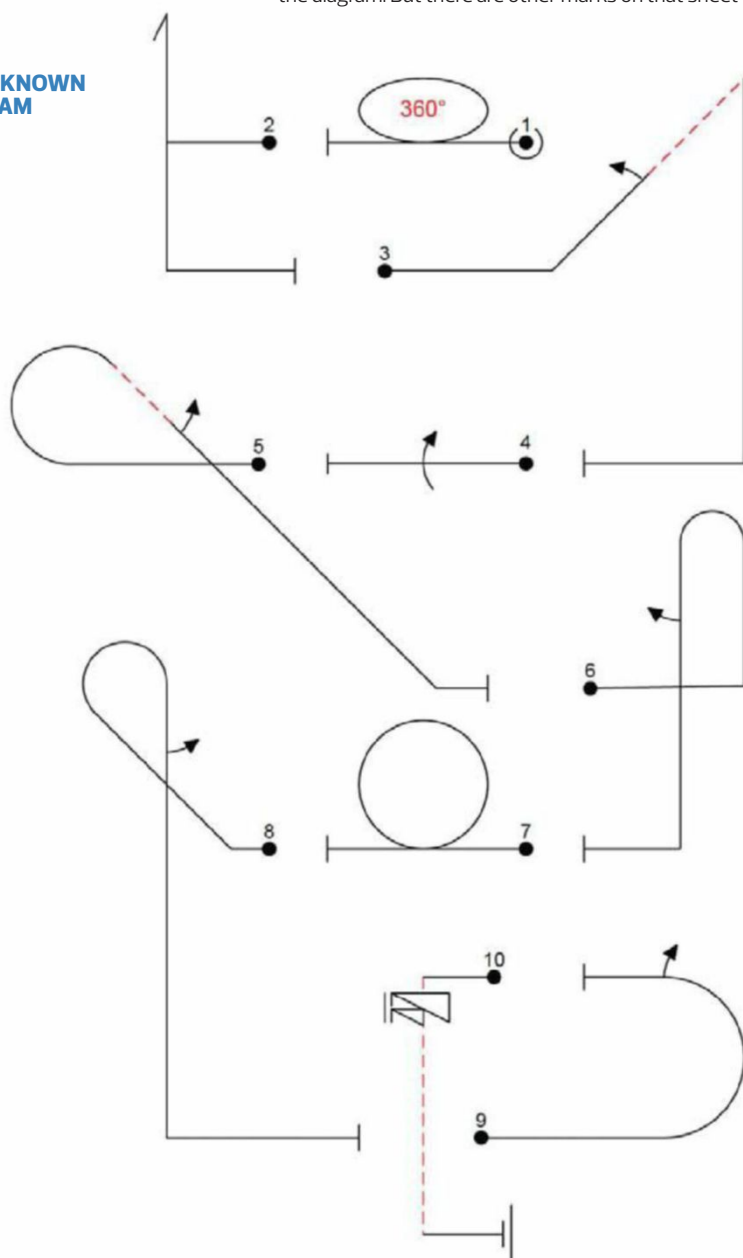
A vertical line is a 90-degree upline (flying up), and a dashed vertical line represents a 90-degree downline (flying down). The maneuver starts at the dot and ends at the short perpendicular line.



A dot surrounded by an outer line means that it is the start of the sequence, and a perpendicular line with a little larger line next to it signifies the end of the sequence.

WIND DIRECTION

BASIC KNOWN DIAGRAM



Each figure has a number, which is the order that it will be flown in the sequence.

Understanding just this will allow you to fly the whole sequence. As you can see from the basic known diagram below, following the straight solid line in the upright positions and the dashed lines in inverted flight, fly the 90-degree solid lines up and the 90-degree dashed lines down. Follow any curved lines as they are indicated in the diagram. But there are other marks on that sheet that we still have to learn.

A BIT OF HISTORY

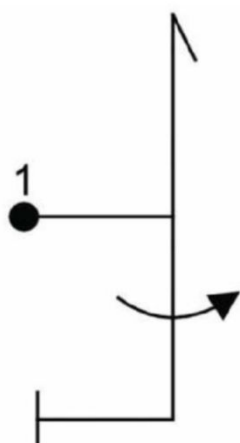
The Aresti system was designed by a Spanish aviator, Col. José Luis Aresti Aguirre, who by the end of 1962 published a dictionary of some 3,000 aerobatic



maneuvers. This came about because pilots who competed internationally needed a way to communicate the sequence in a common language, even if they didn't speak the same language. By 1962, the Fédération Aéronautique Internationale, the world air-sports federation, adopted it and elected to use the catalog of maneuvers at the 1964 Championships. The simplicity of the Aresti diagrams made this system work, and it has been accepted worldwide as the way to draw and read aerobatic figures.

REFINING THE DIAGRAM

The first new symbol you see is the half arrow at the top of the second maneuver, which denotes a hammerhead or stall turn. You will fly your aircraft 90 degrees up, cut the throttle, and let the plane pivot, then follow the line back down 90 degrees and exit a little lower than where the plane entered the maneuver. You will notice that there are no dashed lines on this illustration, even though the plane is traveling down. Remember this: If you push the stick away from you to enter a 90-degree downline, it is a dashed line. But if you pull the stick toward you to enter a 90-degree downline, it is represented by a solid line.



HAMMERHEAD

The next symbols are some curved arrow lines that run through or are attached to the flight path. These show a rolling maneuver—a curved line that is completely through the flightline with an arrow at one end will represent a single roll—but they do not indicate which direction the plane will roll. This direction is up to the pilot. If the arrow meets the flightline, that is a half-roll, and you will notice that the line starts at upright flight. After the half-roll, the line will show inverted flight (dashed line) after the curved arrow. If a maneuver requires a 1/4 or 3/4 roll, the half-roll will have a fraction above it to show that. Rolls such as point rolls can also be performed where the pilot will stop or hesitate the roll for a brief moment at some division of the 360-degree revolution. In this case, a number will be above the arrow indicating the number of pauses during the full roll.



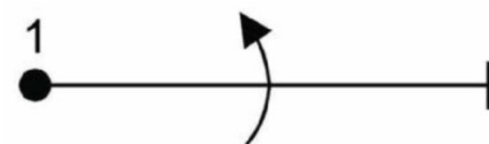
HALF ROLL INVERTED



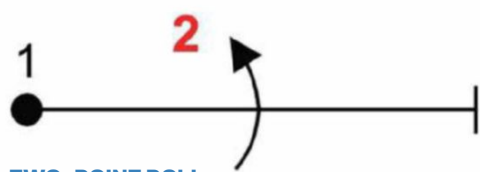
HALF ROLL UPRIGHT



ROLL INVERTED



ROLL UPRIGHT



TWO-POINT ROLL

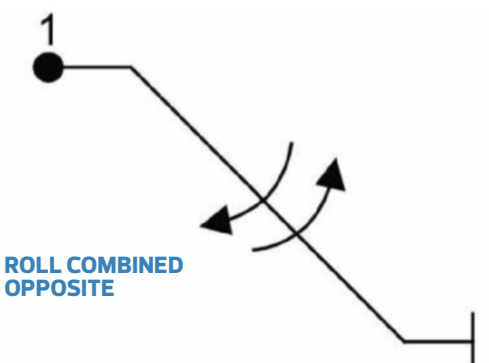
Rolls can also be combined to be performed one after the other in the same or opposite direction. If they are combined and performed in the same direction, there will be a small line drawn over the arrows. But if the arrows are in the opposite sides of the line, these rolls are to be flown in the opposite direction. These combinations can also be combined to include a full roll with a half-roll. We now have all the knowledge we need to perform all the maneuvers—except for the last one indicated by those triangles.



COMBINED ROLLS



COMBINED FULL AND HALF



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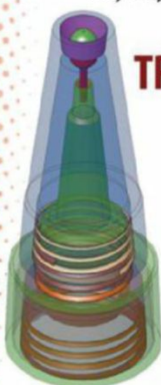
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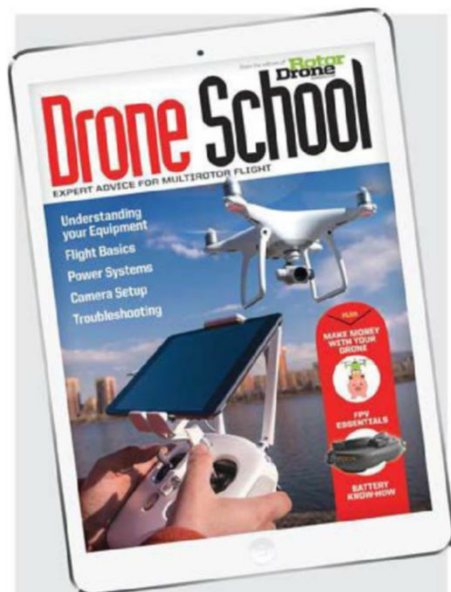


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From the editors of

Airplane

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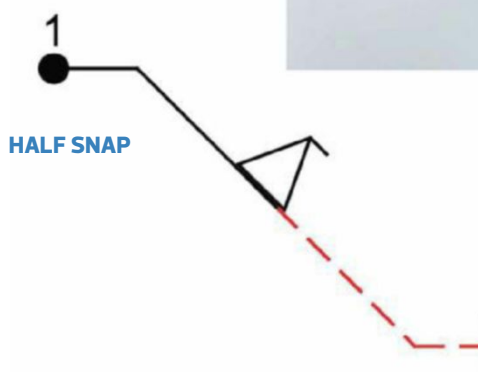
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Both snap and spin maneuvers are represented by a triangle. The ones in the basic known sequence are spins, but let's take a look at both. The snap maneuver is represented with a triangle that has a short line at the corner in the direction of flight. A triangle that sits in the middle of the flightline is a full snap, whereas a half-snap is shown with a small triangle that does not cross the line and appears to be sitting on it. The triangle can be open (white) and that represents a positive snap, whereas a solid color (red) represents a negative snap. Similar to rolls, snaps can be linked or unlinked with each other or even with rolls, but those will appear in the more advanced sequences.



FULL POSITIVE SNAP



HALF SNAP

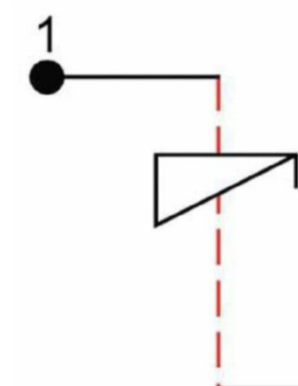


FULL NEGATIVE SNAPS

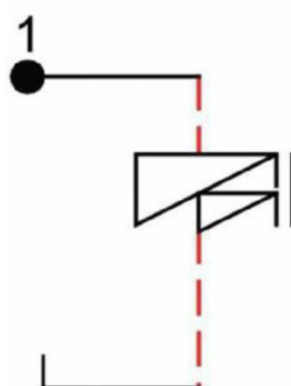
LET'S FLY!

Knowing how to read Aresti diagrams opens the door to your aerobatic world and will be a much-needed skill as your flying abilities progress and you move up into the higher classes of competition. Now that you can read the maneuvers that are given to you, get out there and fly. ✈

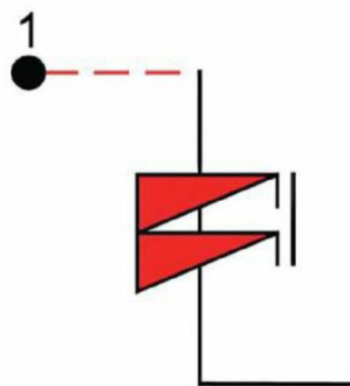
The spin is shown as a right triangle that can also span across the flightline, with a short line pointing down. Spins can also be linked together and would be flown as one figure. A short triangle that sits on the flightline would be a half-spin and would also start with a solid line and have a dashed line after the triangle. Again, the color of the triangle determines if the spin will be a positive (white) or negative (red or black) spin. We can now read this entire sequence correctly and, as a result, fly it to perfection.



ONE SPIN



ONE-AND-A-HALF SPIN



TWO NEGATIVE SPINS

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HOW TO

Balance Propellers

FOUR EASY STEPS TO INCREASE PERFORMANCE AND REDUCE VIBRATION

BY GERRY YARRISH PHOTOS BY PETER HALL



WHAT'S NEEDED

All you need to true up your propellers is a high-quality, precise prop balancer, like the one sold by Du-Bro Products; some sandpaper; some Zap CA glue and kicker; and a prop reamer. I like to use a sanding bar with 100-grit sandpaper as it provides a very smooth surface.

After you build a sport plane, there are a couple things you need to do before you head off to the flying field. For your engine to operate properly you first have the break it in, and before doing that, it's important to balance your propeller. Why? Most, if not all, propellers will be out of balance when you buy them. Some will be close to being balanced, others not so much. The advantage of flying with a properly balanced propeller is the elimination of or a great reduction in vibration. Like the wheels on your car, the effects at low rpm are almost unnoticeable, but as the rpm increases so too does vibration. This adds to the wear and tear on your engine's internal parts and bearings as well as the airplane's airframe.

In addition, your airplane will have better performance with a smooth-running engine and propeller. With glow engines, less vibration means more of its power is transmitted to the prop to produce more thrust. With electric airplanes, it has a similar effect, and you'll also get more flight time from your battery packs.

The supplies you need to balance a propeller are simply some sandpaper, thick Zap CA glue, and some kicker.



LET'S GET STARTED

The first thing to do is to check the fit of the prop to the engine. The hole in the prop hub should be a precise fit with little to no slop or play. If the hole is too big, you can add a couple of layers of tape to the prop shaft until the propeller fits nicely. If the hole is too small, then you should use a prop reamer to precisely enlarge the hole diameter. With the O.S. .25 FX engine used in this article, I used a stepped metric reamer. Reamers are available at most hobby shops as well as online.

When using a reamer, hold it square to the prop hub and gently push it while twisting it counter-clockwise between a quarter and a half turn at a time. Once you have reamed the full length of the hole, back it out while still twisting it in the same direction.

Now place it on the balancer. With the Du-Bro prop balancer, there is mandrel with a solid stop and a movable spring-loaded stop. All you have to do is remove the stop and spring, slide the propeller onto the mandrel, and replace the stop and spring along with the washer and the piece of silicone tubing that keeps the spring compressed against the stop. But before we can balance the propeller, you need to make sure the mandrel is level. You want to set up the side supports so that the propeller can turn 360 degrees without touching the base. Adjust the balancer's height with the four adjustment screws (two on each side) until the prop is free to rotate, then measure the ends of the mandrel, making sure they are the same height above your workbench. If the mandrel is not level, it will be difficult for you to balance the prop precisely.

BY THE NUMBERS

Step 1 Place the prop and mandrel on the balancer to see which prop blade drops to the bottom. This is the heavy prop and you will have to remove some material from the blade using the sanding bar. You can remove some material directly



When the prop is placed on the mandrel, the heavier blade will drop.



Before placing the propeller on the balancer, make sure the mandrel is level by measuring the distance from the workbench to each end of the mandrel. They should be the same distance.

Before balancing your propeller, make sure it fits precisely on the engine's prop shaft. If the hole in the prop hub is too small, use the proper-size reamer to enlarge the hole.

from the very end of the tip, but you should not remove more than 1/16 inch. If this doesn't bring the prop into balance, more work needs to be done.

Step 2 Flip over the prop and the mandrel so that the prop is facing in the opposite direction. See if the same prop blade drops to the bottom. If it does, then you need to remove material from the front and back sides of the blade. It doesn't take very much: Make three or four swipes with the sanding bar, clean off the sawdust, and replace the prop on the balancer; keep doing this until the propeller sits level on the balancer. Once it does, flip it over again so that it is facing the opposite direction and see if it still sits level. If it doesn't, then the hub is slightly out of balance.



Sand the heavy blade, and check the balance again.

HOW TO BALANCE PROPELLERS

Step 3 To determine which side of the hub is heavier, place the prop so that one blade is pointing straight up. When you release the blade, the heavy side of the hub will cause the tip to drop to that side. To bring the hub into balance, don't sand the heavy side but, instead, add some weight to the lighter side.

Step 4 As with the blades, it doesn't take a lot to balance the hub. Determine the lighter side of the hub, and while keeping the prop on the mandrel, apply a bead of glue about an inch long to the lighter side and add some kicker accelerator. Let the glue dry and then place the prop back on the balancer. Keep applying a bead of glue at a time and apply the kicker until the propeller remains pointed vertically when you release it with the tip pointing straight up.

On the lighter side of the hub, apply some Zap glue and spritz with some kicker to accelerate the curing of the glue.



You'll know that your propeller is perfectly balanced when you can place it in any position on the balancer and it remains there without a prop tip dropping. Once this is done, you can use the prop as is, or if you like, you can apply a couple of light-mist coats of clear paint to both blades to seal the surfaces and prevent moisture from getting into the wood grain. Once the paint dries, your prop is ready to use.

The same process can be used with plastic and composite propellers, with the exception of adding a coat of clear to seal it.

BOTTOM LINE

That's about it. I highly recommend going through the effort, whenever possible, of balancing all your propellers before flying. And since you might accidentally damage a prop, you should have a couple of spares (and a balancer, of course) in your field box. ±

To check the balance of the prop hub, place the propeller vertically so that one tip points straight up. The heavy side of the hub will cause the blade to fall toward that side.



With a wood propeller, you can spray a light-mist coat onto the blades to seal the surfaces. Apply paint to both sides of the propeller evenly to maintain balance.

Your propeller will be properly balanced when it can be placed at any position on the balancer and it doesn't move.



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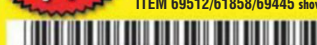
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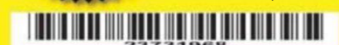


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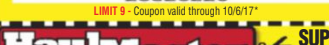
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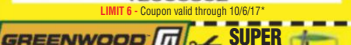
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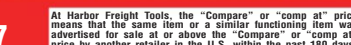
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Connex Falcore

With built-in stability, it's a perfect first FPV racer

BY JOHN REID PHOTOS BY CHERYL VOMACKA MALTBY



Connex has been in the wireless video transmission business for a long time, and it has the most reliable technology so far. When I heard that Connex had decided to design a racing drone, I knew it would be unique and cutting edge, and that is exactly what the Falcore is: an innovative and fun drone for first-time- and experienced-racers.

HIGHLIGHTS

This racer comes in a nicely designed box with everything you need inside to get it in the air. The Falcore is fully assembled with the props installed, and extra props are also included. The carbon-fiber arms are attached to the body (also made out of carbon fiber) with O-rings. The O-rings provide rigid support, but if there's a hard impact, the arms will dislocate to prevent damage to them and the motors. All of the expensive and vital equipment (receiver, video transmitter, speed control, and camera) are protected inside the carbon-fiber tube of the body. The video antenna slides in and locks at the back top of the fuselage. A cavity at the rear of the quad allows easy access for the battery pack.

Getting this bird ready for flight consists of charging the flight battery and transmitter, then attaching the ProSight receiver to the transmitter and attaching the antennae. All of the setup instructions are on the front page of the manual.

The Falcore's real advantage, next to its outstanding and uninterrupted video signal and up-to-80mph flight speed, is its simplicity of flight. A switch on the front of the transmitter has three flight modes: Shield, Horizon, and Acro. Shield mode is ideal for anyone who's just getting started in the world of FPV flight (more on this later). Horizon mode keeps the drone level and cancels out any inputs when the sticks are returned to the home position, and Acro mode leaves it up to the pilot to keep everything level and to control and/or cancel any previous stick inputs. Both Horizon and Acro modes are for experienced pilots.

AT A GLANCE



MODEL:
Falcore



MANUFACTURER:
Connex (amimon.com/fpv-market)



TYPE:
Racer



SIZE:
190mm



ASSEMBLY TIME:
5 minutes



FLIGHT DURATION:
5 to 7 minutes



CAMERA QUALITY:
ProSight system
720p30 HD (included)



PRICE:
\$799.00

WHAT WE LIKE

- + Fast—up to 80mph
- + Shield mode allows anyone access to FPV racing
- + ProSight HD video—no video interference
- + Solid frame that is completely assembled



THE FALCORE'S REAL ADVANTAGE, NEXT TO ITS OUTSTANDING AND UNINTERRUPTED VIDEO SIGNAL AND UP-TO-80MPH FLIGHT SPEED, IS ITS SIMPLICITY OF FLIGHT.





The three main components of this kit are the transmitter, the ProSight receiver, and the Falcone drone.



The ProSight receiver easily slides on and locks to the transmitter.

AERIAL RECAP

Most of this section will talk about the Shield mode of flying, which is truly a fun way to learn to fly and race. In Shield mode, the drone flies in the direction of the right stick. The racer's altitude is controlled by the left throttle stick, and the Falcone will fly just 3 feet above the ground. Its flying height is regulated by the two sensors on the bottom of the bird. In addition,

if the right stick is pushed to the left, the quad combines the bank and yaw in that direction to fly a smooth turn every time. You can add in additional yaw with the left stick.

The three-way on/off switch has a standby click that turns on the transmitter and powers up the Falcone so that the video feed starts and can be seen in the goggles. Moving the switch to the arming position will allow the motors to start

up when the throttle stick is pushed forward.

When you're flying the Falcone, it will maintain its altitude relative to the ground, and it's fun to watch the altitude change as the racer moves over higher and lower ground. Be aware that grass, snow, and water may interfere with the sensor. There are no sensors to prevent the Falcone from crashing, but it can take a pretty good hit and still fly.



The battery slides into the rear of the Falcone and locks in. Notice that the motors are tilted to keep the Falcone body level during flight and minimize wind drag.

Self-Leveling and Stop & Land Features

There are two features on the Falcore that help out folks who want to advance their flying skills while still having a safety net available if they need it. These two features are the Self-leveling action in Horizon mode and the Stop & Land button. When you're flying in Horizon mode, you have full control of the quad. You can bank, roll, or loop, but if you become disorientated, just let go of the sticks and the Falcore will right itself and level out. That's a cool feature to have when you are learning new moves, but it gets even better! In any mode, you can hit the Stop & Land button for quick action: the quad will immediately upright itself (if needed) and stop in a level position, then slowly begin to land. If you let go of the button, the quad will then continue its flight; continue to hold it down and the Falcore will continue to descend and land. These two features make the Falcore a perfect quad for any pilot, not just the beginner.



The Stop & Land button is located on the side and within easy reach.

The Shield, Horizon, and Acro mode switch is located at the upper right on the controller. The standby and arming switch is at the lower right.

BOTTOM LINE

The Falcore is designed for new racers who might be intimidated by hard-core drone racers that require skill and practice. But that doesn't mean an experienced pilot will not enjoy this up-to-80mph bird; I am having a blast flying it—and so will you. ✚



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GOOD HABITS APPLIED

An easier path to better flying

TEXT & ILLUSTRATIONS BY DAVID SCOTT

Those who have followed my articles over the years know that I derive the content from three decades of training RC pilots of all skill levels during my flight school's four-day accelerated courses. I bring this up knowing that most club pilots believe that how they currently fly works best for them. The reality, however, is that most pilots require extensive practice for small gains and many have plateaued. A four-day training deadline has a way of focusing attention on the things that matter most to ensure pilots continue to improve at a steady pace.

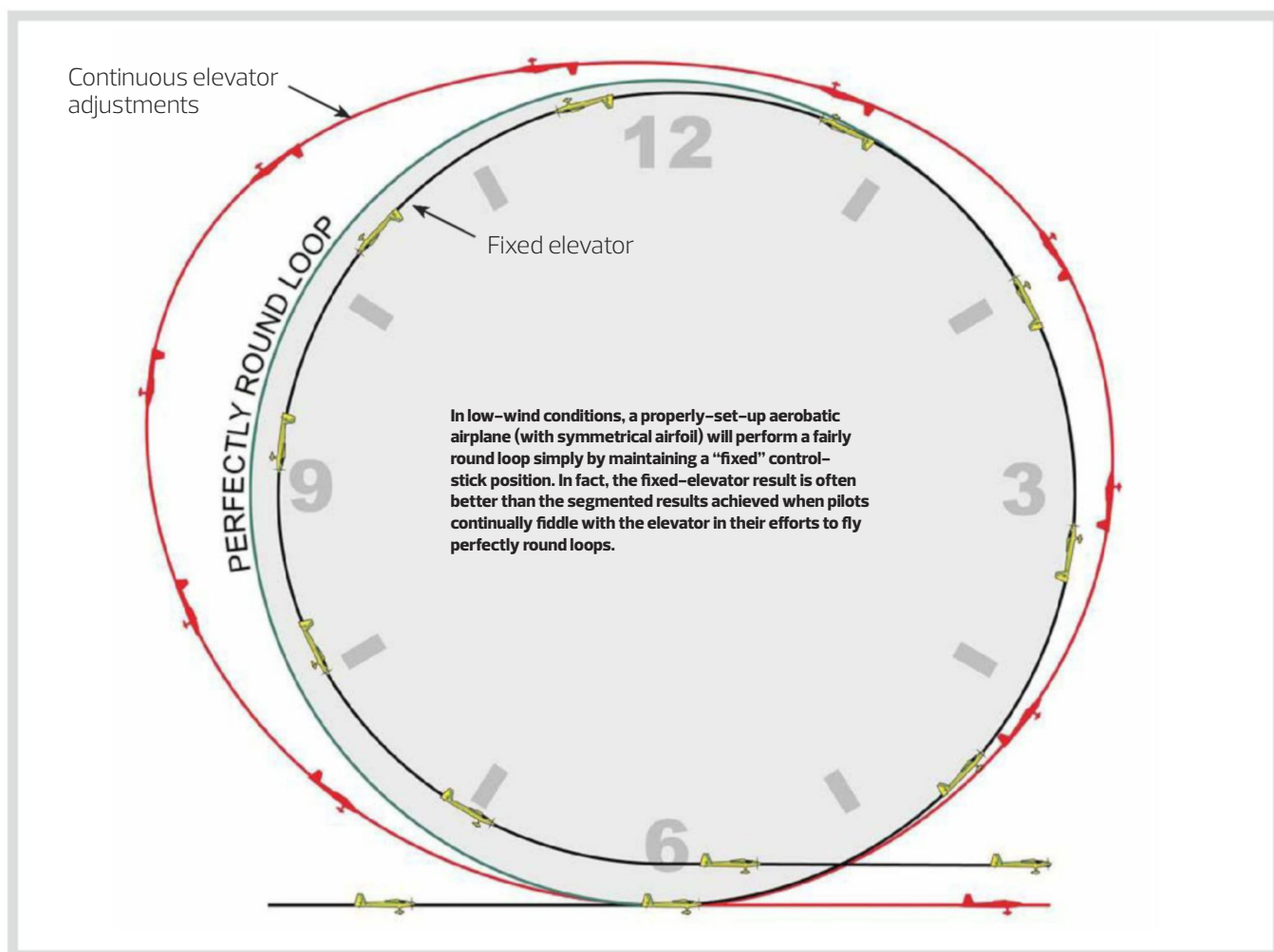
That said, over the past few months, I have been presenting solutions to the bad habits that hold back self-taught aerobatic pilots from making steady progress. To recap: all bad habits can be traced back to a lack of planning. By default, most pilots learn to fly through a process of trial and error and reacting to the airplane. By definition, reactive pilots need to see a deviation before it occurs to them that a correction is/was needed. Due to the compound effect that a deviation has on the remainder of the maneuver, "reactors" become conditioned to making constant corrections. As a result, no two attempts ever turn out the same and, thus, there's little consistency regarding the types of corrections needed. Hence, most pilots end up thinking that the key to better flying is getting better at reacting to deviations. (This reminds me of how Northeasterners respond to someone who is promoting something that clearly doesn't work as well as he thinks it does: "So, how's that working for you?!")

The great news is that there are much simpler, less demanding, and more consistent methods to develop aerobatic proficiency (see my articles in the May and July issues). My intention this month is to walk through what it actually looks like to put those strategies into practice to achieve greater flying proficiency in the most efficient manner possible.

BUILDING PROFICIENCY

The nature of precision aerobatic flying is that when the maneuvers are performed by a proficient pilot, the airplane appears to be flying on rails. There is often no indication of when refinements were added except for the fact that the





airplane flew the proper path (which is why purely reactive fliers are seldom able to consolidate refinements). To achieve this level of precision and consistency, pilots must learn to proactively control the airplane rather than merely reacting to it. In short, that means paying attention to the control inputs you make at different stages of the maneuvers in order to develop the proper muscle-memory motor skills. This process can be likened to developing a proper golf swing or programming a machine (yourself) to consistently repeat the correct movements.

Muscles don't actually store memories—the mind does. Instilling so-called “muscle memory” (aka procedural memory) involves consolidating a specific motor task into memory through consistent repetition. Once those memory patterns are instilled, performing the maneuvers becomes almost automatic. I can perform, for example, a nice slow roll low to the ground while holding up the transmitter and discussing my inputs with my students and only peripherally pay attention to the airplane. I can do so because I know (trust) that if it worked the previous 100 times, there's no reason to think that it won't turn out the same the 101st time as long as I do everything the same.

When I teach, this process begins with walking students step by step through the

basic execution of a maneuver. I then explain that every airplane will consistently exhibit certain tendencies (deviations) each time the maneuver is performed. To master the maneuver, we must first focus on the basic execution, and the airplane will show us along the way what needs to be done to subsequently improve it.

LOOPS

Regardless of how your plane is set up, you need to recognize that there is a specific amount of elevator that will produce the ideal-size loop—not too big, not too small. Thus, before becoming concerned with how round it is, that amount first needs to be determined. (My students seem to grasp this concept best when I assign their name to the amount of elevator each person uses—e.g., “Tom's loop” amount or “Steve's loop” amount.)

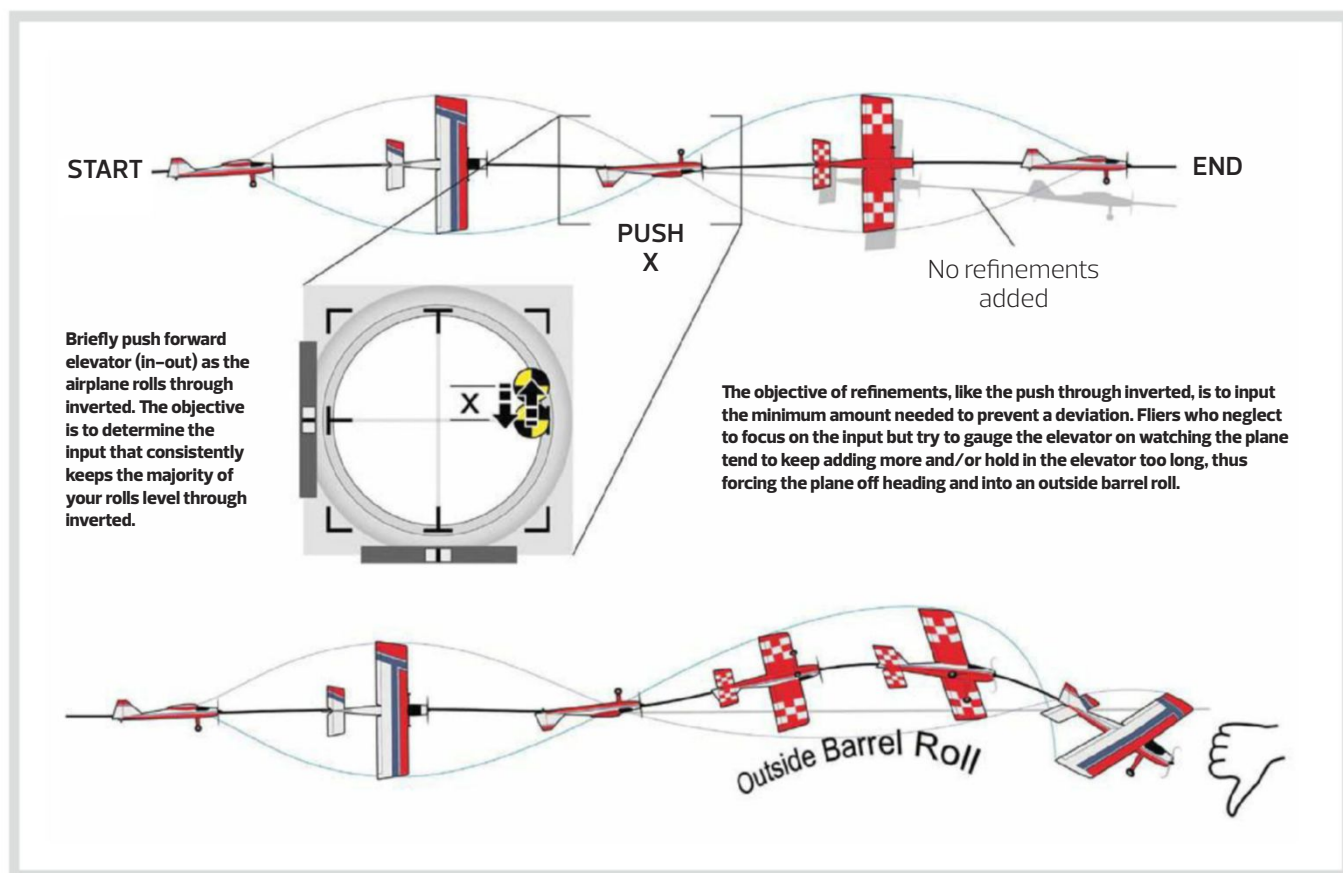
As I've been stressing for months, if you initially target too little or too much, the only way to truly fix it is to go back in time and start over. Since that's not possible and fiddling with the elevator will only serve to complicate the maneuver for no gain, the wise thing to do is lock in whatever amount you started with and try to learn from it. The point is, if you don't fiddle with the elevator, it won't take more than a few tries to determine the exact amount that

produces the right-size loop for you.

Along the way, you will be amazed to discover that, barring a strong wind, most aerobatic airplanes will perform reasonably round loops if you simply lock the elevator in place. In fact, some will find it difficult to find any fault at all. This always comes as a shock to pilots who had been making constant elevator adjustments throughout and thought that the reason their loops were irregular was due to the plane or struggles with eye/hand coordination. The reality is that 90 percent of pilots would achieve nicer overall loops with the elevator locked in place than when they try to fly a perfectly round loop (Figure 1).

It typically takes 10+ seconds to perform a complete loop. That is a long time doing little more than holding the elevator in place for you to detect where your loops are prone to departing from round. The first deviation that a pilot might observe is a slight tightening of the loop or “pinching” over the top due to the effects of gravity. Once confirmed, the elevator input will need to be reduced somewhat between 10:00 and 2:00 to maintain a constant radius.

Here again, barring strong winds, there is a specific amount to take out that will work 99 percent of the time. If you loop with 1/4 elevator, for example, reducing the input by 1/16 inch may work great. One thing is certain:



If you don't proactively focus on the control input but try to perform this step by merely watching the plane, you will invariably take out too much elevator and end up flat-spotting the top of the loop (and end up with a poorer result than if you left things alone). Remember, if you do take out too much or too little elevator over the top of a loop, fiddling with it will only further complicate the maneuver while drawing more attention to the error. Thus, you are better served to commit to whatever adjustment you made—even if it's incorrect—and try to learn from the result so that you can do it better next time. In this way, aerobatic practice is akin to a normal flight—no one remembers the earlier flaws when you finish strong and grease the landing!

The elevator is then proactively returned on the back side of the loop to the fixed amount that you started the loop with. By trusting your inputs and refraining from fiddling, the results will prove so consistent that you might also detect your loops consistently become tighter approaching the finish. In that case, aim to slightly reduce your elevator input approaching the bottom of the loop (starting near 4:00 or 8:00) to avoid "hooking" the finish.

Note: As a rule, proficient pilots greatly simplify their flying by having only two "pulls": the baseline amount we automatically pull when performing loops, and a somewhat larger input when pulling more assertively into and out

of vertical and 45-degree lines. When I teach the latter, I encourage my students to target slightly more elevator than what they normally loop with. If we like the radius, that's the input we'll target in those scenarios until it becomes automatic.

ROLLS

Another example of proactive control is adding the elevator push during the inverted segment of a roll to prevent an altitude drop. The first step is to recognize that the only time the push is needed is through the inverted portion of the roll, and it should be removed soon after the plane has rolled past inverted. Thus, unless it's a super-slow roll, the push should last no longer than the time it takes to apply a smooth "in-out" input (Figure 2).

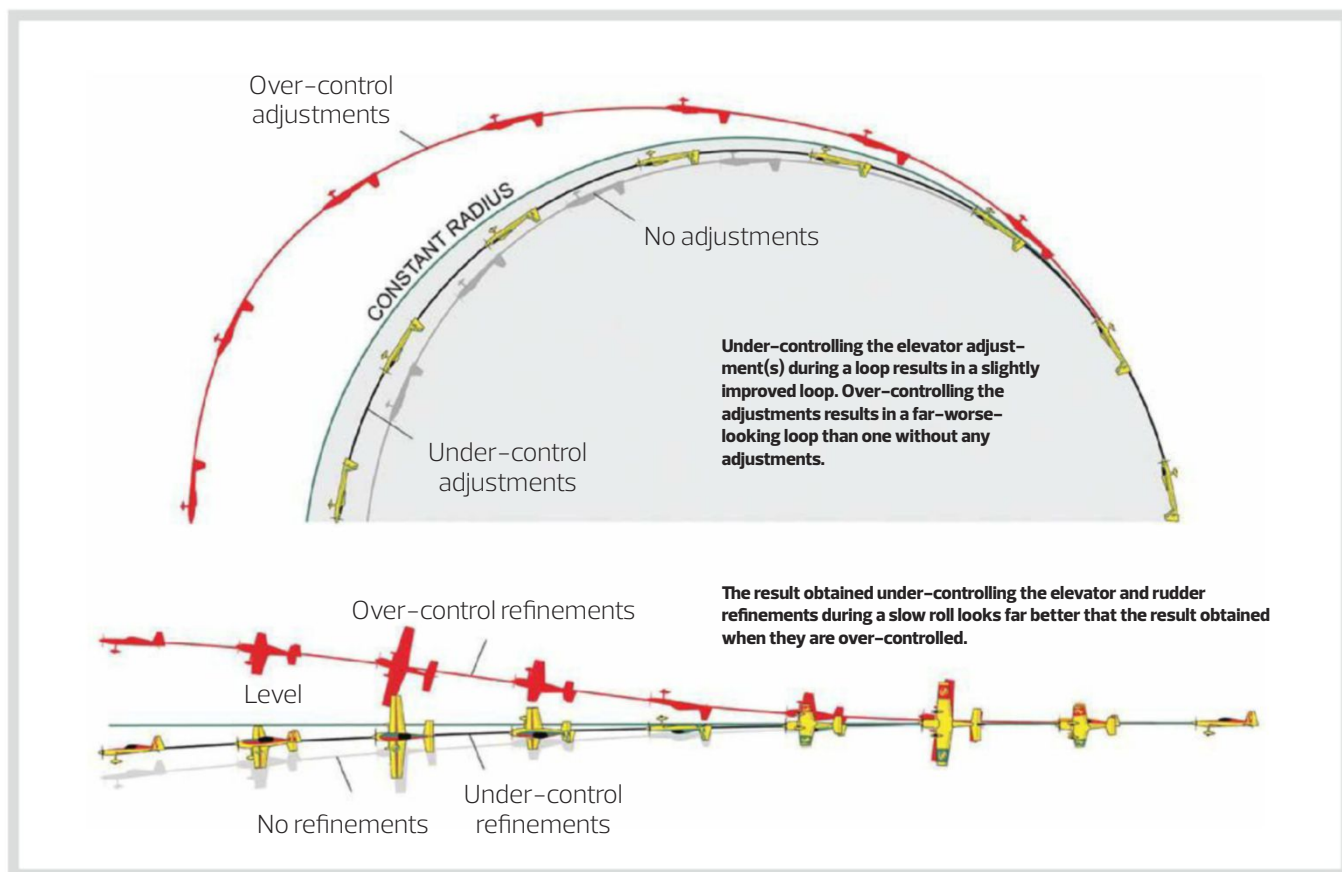
The next step is to recognize that there is a specific amount of push input that will keep the roll level every time. And since the push is a precision refinement, the aim is to use the minimal amount of elevator needed to get the job done. That is, you're not looking for the nose to pitch up, but rather, you should be seeking to identify the push input that keeps the plane from dropping irrespective of the fuselage.

As quickly as the airplane rolls through inverted, there usually isn't enough time during the roll to adjust the amount of push if it proves to be incorrect. Indeed, if you did attempt to

adjust it, you'd likely end up turning a slight mistake into a worse mess. Hence, if you target a 1/4-inch push and it proves to be too much, make a mental note to push 1/8 inch next time rather than meddling with it. The point is that the only way to truly fix the wrong input is to go back in time and start over. So instead of making it worse or becoming dejected, turn the mistake into a learning opportunity!

Reactive pilots invariably struggle to consolidate the push because, each time, the results are different. But as long as you recognize that the push is a trust exercise, with attention focused on the control input, it won't take long to consolidate the muscle memory that will enable you to consistently perform this step without having to think about it.

Note: I will occasionally have a student with a bad habit of trying to react to the plane, thus causing him to repeatedly hold the push too long. So I'll have him perform a series of rolls looking down at his fingers while I watch the plane and call out when to briefly push. After the other students in the class confirm that the rolls were nearly perfect, everyone is convinced that the key is focusing on the input. I'll make the same point with round loops except that I will perform the loop without looking at the plane and my students will tell me when the plane reaches 10:00 and 2:00 to trigger my elevator adjustments. When it's over, I usually



get a “10” from the class. So how did I know how much elevator to take out over the top of the loop (or, for that matter, how much to push during a roll)? I based my adjustments on how much the plane dropped during the earlier attempts without the refinements being added.

If you're able to grasp this proactive crawl-walk-run approach to practice, you will discover that it can be applied to any precision aerobic maneuver. When introducing rudder to the knife-edge segments of a super-slow roll, for example, the objective is not to see the tail move (just the opposite) but to input just enough rudder to prevent an altitude loss. If you input the wrong amount, take note of the result and apply the appropriate change to the next attempt, rather than fiddling with the rudder and further complicating the maneuver for no gain. The process is the same when determining the amount of rudder needed to keep loops from pulling to the left due to propwash, or the amount of elevator needed during knife-edge to keep the plane tracking straight, or the amount of opposite rudder needed after a snap roll to return the plane to its original heading, and so on. In each scenario, the solution is to identify the input that will consistently do the job, then repeat it until it becomes automatic.

UNDER-CONTROL TO PERFECTION

The most important ingredient that enables

pilots to rapidly incorporate refinements into their maneuvers is consistency. If that condition hasn't been met, attempting to add refinements will prove fruitless. For those who have indeed established consistent baseline inputs, the following habit will expedite your ability to look like a pro when inputting a refinement or preventing a deviation. Always aim to initially under-control the input, especially when the amount needed isn't known. This does not mean to keep the input small; it means, literally, to input too small of an adjustment. Like any pro, you need to understand that if you don't input enough, you will have still improved the maneuver. But if you apply too much, the damage cannot be undone without drawing even more attention to the error or ruining the maneuver (Figure 3).

It takes vigilance to learn this habit because the natural tendency is to keep increasing or reducing the size of the inputs until you see something change; as a result, pilots end up having to fix their own fixes. The reality is that when most refinements are executed correctly, there is often no indication that an adjustment was made, except for the fact that the airplane flew the proper path. Initially aiming to under-control your refinements is the best way to achieve that objective.

FINAL THOUGHTS

These habits will, no doubt, come across as

foreign to those who have always believed that more stick time (aka, trial and error) and better reactions are the only ways to improve. These habits, however, are aimed at those who seek to rapidly acquire proficiency. Proficient pilots aim to proactively control the airplane and recognize that “it's not how you start that counts; it's how you finish!” #1: The plane reflects the inputs that were made. Hence, if you don't like the results, you need to look to the source and change your inputs, rather than merely trying to get better at reacting to the consequences of inconsistent inputs. #2: We use our first attempts not to see how well we can do but to identify (learn) the inputs that will enable us to consistently achieve excellent results, leading to the muscle memory that causes the maneuvers to become largely automatic. Reacting has its place, of course, and the sooner the maneuvers become routine, the easier it will be for you to pick up on the small touches that will enable you to perform the maneuvers nearly perfectly. The best news of all is that this process doesn't require a lot of effort or special talent (just the opposite) and is, therefore, easily adopted, even by veteran pilots. Thus, if you're a little older and/or don't get to practice as much as you would like, the crawl-walk-run approach should be up your alley! Good luck. ✈

Keep Those Vintage Engines Running

[Q&A] Email your questions to Clarence Lee at MAN@airage.com.

We have good news for owners of Fox engines. While working on this column, I received a phone call from my good friend Randy Linsalato, who, along with his wife, Anching, owns MECOA/K&B (mecoa.com). Randy had just returned from Arkansas, where he had purchased Fox Manufacturing. Although the tooling and casting dies were part of the sale, Randy has no intention of continuing production of the engines. However, he did receive a large inventory of parts that he will be making available, probably by the time you are reading this. After 70 years, Fox Manufacturing is now back in Irwindale, California, and only about 30 miles from Van Nuys, where Duke started the business.

Experimental reduction-geared twin using two HP 61 engines built by Bo Siegelhoff, who headed CB Associates. This company is now owned by Randy and Anching Linsalato, also owners of MECOA/K&B. The engine could run as either opposed or alternate firing; the power was about equal either way, but the opposed firing method had less vibration.

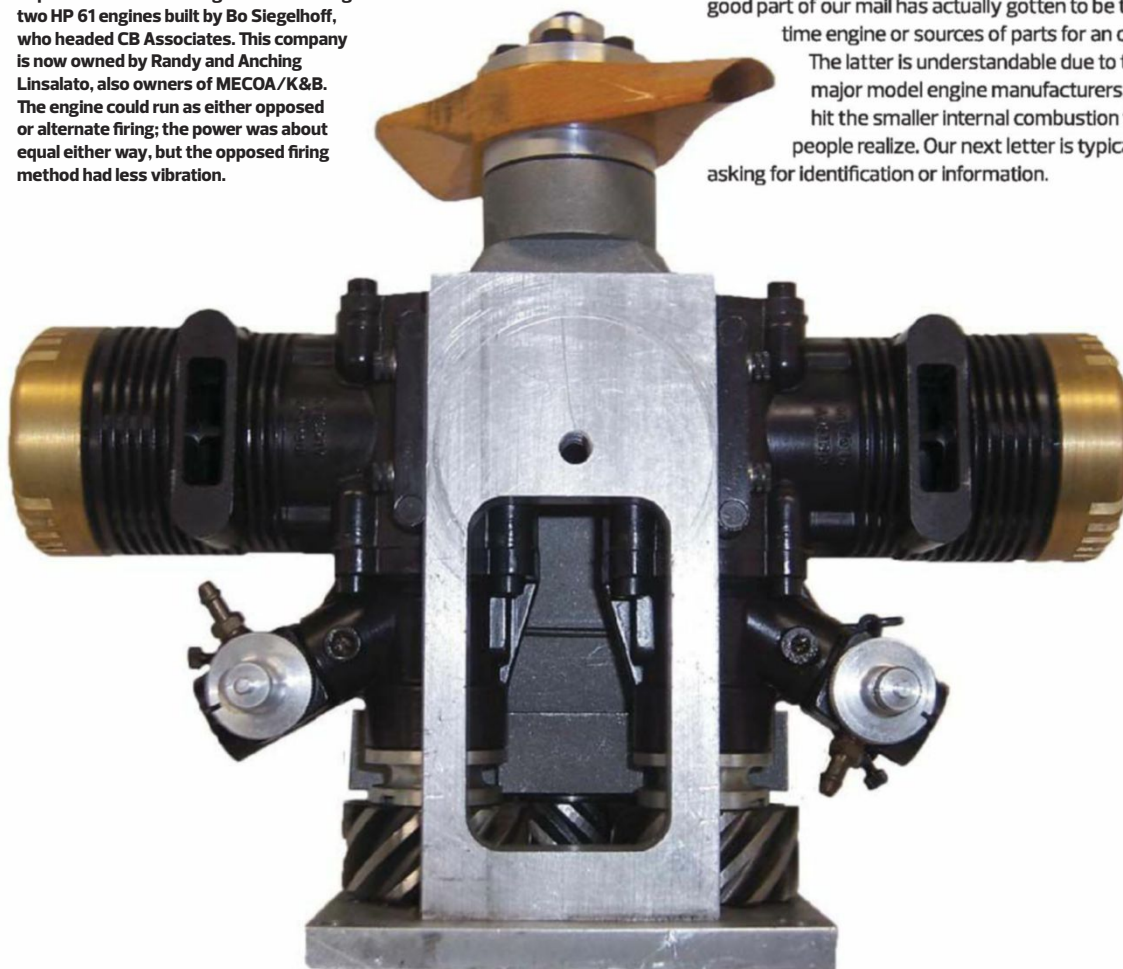
GEARED ENGINES

✉ In the early 1980s, Webra and O.S. offered .61-displacement, geared two-stroke engines for RC flying. These geared engines could swing larger props, which were more effective for large-scale models. This seemed like a good idea, but eventually the geared engines were discontinued. I seem to recall there was an FAI rules change that allowed four-stroke engines with larger displacements to compete against the two-strokes. Was this one of the reasons why the geared engines did not survive? I would appreciate any opinions you have in regards to the Webra and O.S. geared engines.—Ray Leone, St. Charles, IL

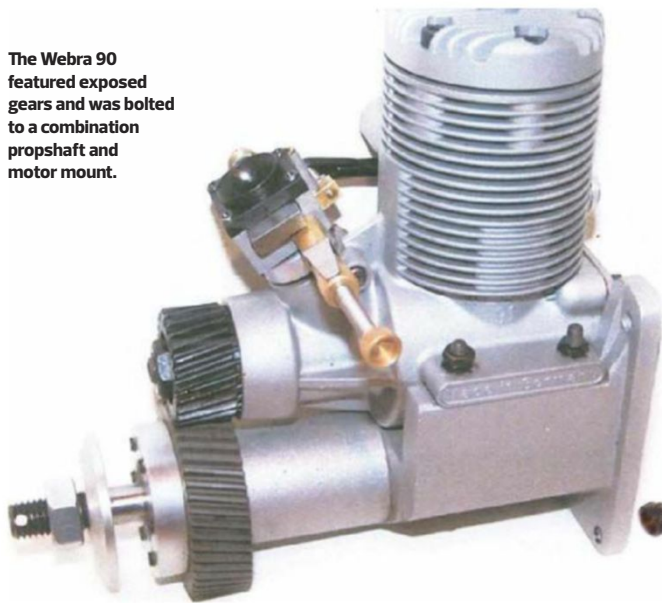
Answer: Ray, back in the 1980s, the AMA had a displacement size limit of 10cc for competition pattern flying. When the four-strokes came along, the displacement size was raised to 20cc for the four-strokes due to their lower power. Even so, most fliers stayed with the two-strokes due to their lower weight and size. Several companies, such as Webra and O.S., started marketing reduction-geared engines that would swing larger props at lower rpm for those using larger aircraft. Then, as larger two-strokes started coming along, the rules were changed to allow for the larger engines, and there was no real need for the geared two-strokes. Another side problem was that with the reduction gearing, which was usually two to one, the engines had to turn 18,000 to 19,000rpm for a prop rpm of 8,000 to 9,000—not a very scale sound if you had a scale-type aircraft.

As regular readers of the column know, from time to time, we run letters and pictures of an old-time engine that a reader wants identified. A good part of our mail has actually gotten to be the identification of an old-time engine or sources of parts for an out-of-production engine.

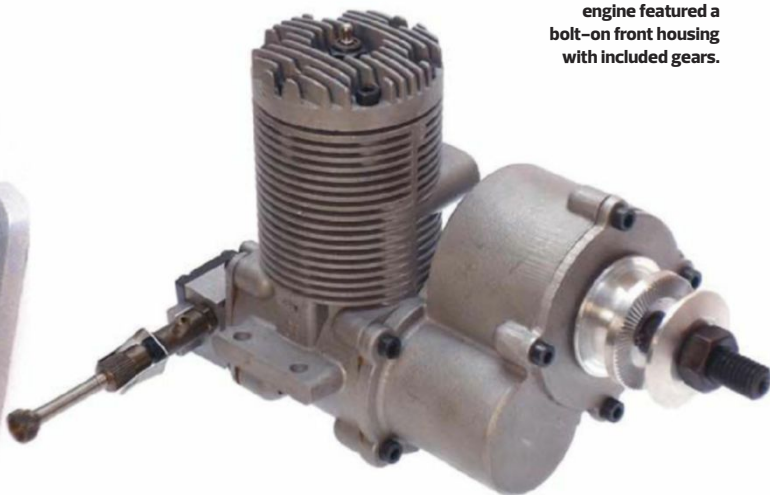
The latter is understandable due to the closure of many of the major model engine manufacturers. The swing to electrics has hit the smaller internal combustion field harder than many people realize. Our next letter is typical of many we receive asking for identification or information.



The Webra 90 featured exposed gears and was bolted to a combination propshaft and motor mount.



The Webra 61 reduction-geared engine featured a bolt-on front housing with included gears.



MOHAWK CHIEF 29

✉ Through friends of my wife, I inherited an older plane and engine. In the attempt to rehab it, I found the wood was beyond rotted out. Would you have any insight on the engine? There aren't any manufacturing markings outside, and it has a raised image of an Indian head on the side opposite the exhaust. I also don't want to let an engine sit on a shelf or box and collect dust. Would this be anything that a collector might want?—Chad Jewell

Answer: Chad, identifying your engine was an easy matter. When you mentioned an Indian head, it could only be a Mohawk Chief 29. The engine was made by the Herkimer Tool & Model Works in Herkimer, New York, and founded by Charles Brebeck. The company produced the OK line of engines, and the OK 60 was a very popular engine prior to and following World War II. Except for the Indian head on the engine bypass, the engine was identical to the OK 29 and sold through a fake company in Mohawk, New York. The OK 29 sold for \$16.95 and the Mohawk Chief for only

\$8.95. It was first marketed in 1947 as a spark-ignition engine and later as a glow version. The engine had either a blue or gold nose cap where the timer had been. Although your engine does not appear to have the nose cap, the timers were often removed and the engine was run with a glow plug after they were introduced in 1947.

Your engine appears to have an original OK glow plug installed. Production ceased in about 1975, although Charles Brebeck's grandson, Ted Brebeck, still operates the company and sells 1/2 A engines assembled from original parts. As far as value, an original new-in-box engine could sell for as high as \$125.00. Without the timer and box, it's about \$50.00 to \$60.00 and even less if in rough condition.

ENGINE DOESN'T RUN LONG

✉ I just cannot get my new O.S. 155 to run properly. It is mounted inverted on a PT-19. It starts with no trouble. Then, after about five to 10 minutes, the engine just fades. You can slowly lean it out (but not too lean) and then richen it again, but it still starts to fade after time. Then it needs to cool off before it will start again. It will start running rich, but after two or so minutes, it will fade even if you leave it running rich. To have one flight with the plane, we kept the onboard glow switched on and set the needle rich. Today, we cannot get it to run properly; it keeps fading off at full throttle.

It is almost as if it is getting too hot, even though it is not mounted in a cowl. Is this a problem with the pump? The back O-ring has melted, and the manual says if this happens, it is overheating. Fuel is Nitro-X, 10%. What on earth is wrong? This very frustrating, and I do not know if I should take the engine off the plane and put it on a test stand.—Stephen, via email

Answer: Stephen, I'm pretty sure your problem is just a matter of not having your fuel tank vented or the vent plugged. As the fuel is used, a vacuum forms that eventually leans and kills the engine.

TROUBLED .91

✉ In about 1995, I bought a new-in-box O.S. .91S from a friend. I remember that it was the most expensive engine I had ever bought. I bought a Hobbico Extra 300S to put it on and was looking forward to flying a four-stroke. I had built many planes up till then, so I knew not to change anything from the tried-and-true ways of engine mounting, tank location, and fuel-line placement. I build slowly because I check every aspect of every item as I install it on the plane. This has always worked for me, and I generally have no problems at the field. However, my O.S. .91S would always go sour in the air. At first, I thought I was setting it too lean. I tried richer mixtures, but the sour or lower performance would still occur. This problem seemed to occur at different times in the flight. It seemed

The 1948 glow-ignition version of the Mohawk 29 was one of the better-made low-cost engines that appeared on the market following World War II.



ENGINE CLINIC

TIP OF THE MONTH

When the four-strokes first came on the market, most came with a choking device that was great for those cowled installations. However, if the engine did not fire up right away, it would keep spinning the engine with the electric starter with the choke still closed. Fuel would soon be running off the tail of the aircraft. With an inverted installation, this usually resulted in a hydraulic lock, in turn, resulting in a broken rod, wristpin, or crankshaft. As a result, most four-stroke engine manufacturers no longer equip their engines with a choking device. So how do you choke the engine without cutting a hole in the cowl for your finger? Easy! Just put your finger over the muffler tailpipe while flipping the prop or spinning the engine with the starter. Muffler pressure will then force fuel to the carburetor.

like it was a fuel-draw problem. But the hold-the-nose-up preflight test revealed no problems. I tried a fresh plug, fresh fuel, and the suggested prop size. Then, one day, another club member arrived with a similar engine on a biplane. I noticed that he was having the exact same problem I was having. If you throttle back off a bit or work the throttle, it would postpone it a bit and you might avoid a dead stick. I got used to doing this but the very short flights were annoying.

I also noticed that the muffler got very hot. Soon, it was black with burnt oil. I watched the other guy's engine and it too went that way. I was amazed that, soon after that, O.S. Engines introduced other models of the O.S. .91S: the O.S. .91SII and O.S. 91SII-P. They had some extra fuel-pump thing at the back of the engine. I am an engineer, so I know that things are normally added to an engine to cure some problem or other. Do you know what the story was about the O.S. .91S? Was there a cure for its problems?—Chris, via email

Answer: Chris, the O.S. 91S has proven to be a pretty reliable engine, and I seldom get any complaints regarding it. However, the four-strokes do have a narrow top-end adjustment range that makes fuel-tank location and size more critical than with a two-stroke. First off, I am assuming that you are using muffler pressure; if not, be sure to do so. Do not use a larger tank to get a longer flight; something in the 12- to 13-ounce range should give you a 10- to 12-minute flight. Be sure the centerline of the tank is no

Here you see the choke slide plate that was used on this older Saito FA-30 four-stroke engine.



lower than 3/8 inch below the needle valve and that the tank vent is not being blocked by the hatch block. Other than this, I do not know what else to offer.

FROZEN CARB

✉ I have an O.S. LA .46 engine. My problem is the carburetor rotor is stuck in the carburetor body. It does not move. I tried the antifreeze-in-the-crock-pot method from August 2003 issue of RCM. I tried Kroil Oil, with no luck. Any suggestions will help. Thank you in advance.—Dennis Stringfield, via email

Answer: Dennis, antifreeze and a crock pot work well for cleaning up a cruddy engine and disassembled parts, but I have never had much luck freeing up stuck parts, such as the cylinder sleeve, as you have found out.

I was not familiar with Kroil, so I checked it out on the computer; I see that it is similar to Liquid Wrench II, which is intended for freeing rusted and corroded parts. Like Liquid Wrench, it is probably petroleum-based and not too effective on hardened castor oil and some of the synthetics. Just use a heat gun or hair dryer and heat the carburetor. The barrel will come loose. Then, lubricate with a penetrating oil, such as Marvel Mystery Oil or 3-in-One.

That wraps up another one, gang. If you have a problem or question, don't leave it up to the other guy. Note that we now have our own e-mail address at the start of the column where you can send your letters. ✉

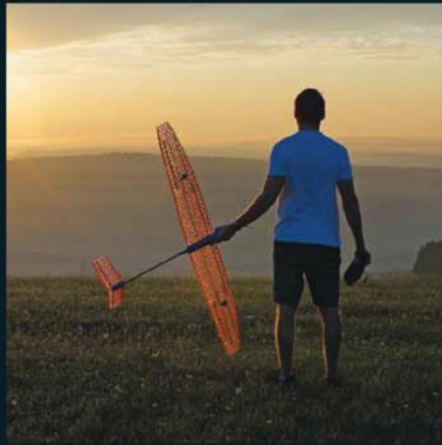


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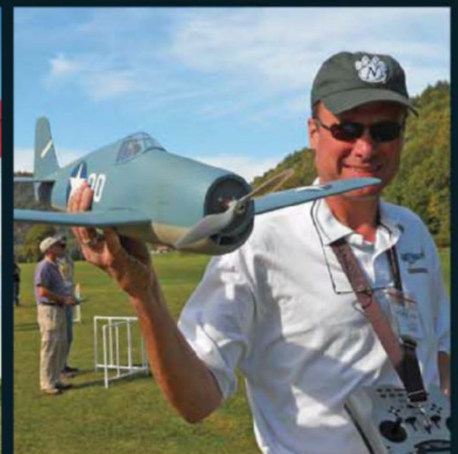
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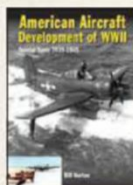
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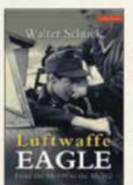
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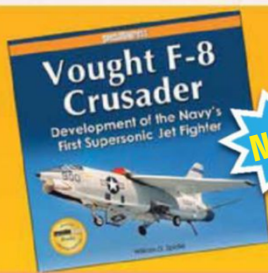
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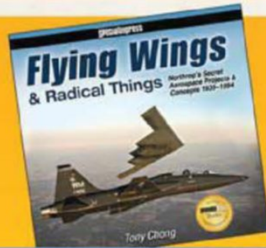
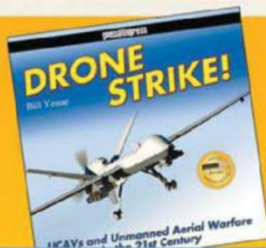
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DIY Racer

KIT BUILDING MADE EASY

TEXT & PHOTOS BY JIM RYAN

First-person-view (FPV) racing has changed the face of radio control. World-class race events and network TV coverage have combined to pull in huge numbers of racers with no prior background in traditional aeromodeling. While there are some nice ready-to-fly quadcopters on the market, FPV racing is ideal for those who like to build their machines. Building your own is easy and fun, and it makes repairs that much simpler.

There are lots of online resources covering every aspect of FPV building and setup, but sifting through it all can be a bit intimidating. In this article, we'll lay out a simple recipe to remove the confusion. The tools involved are minimal, but you should invest in a couple of good-quality variable-temp soldering irons (one 7- to 10-watt for fine work and a heavier 20- to 40-watt unit for power wires).

The basic quadcopter is really

pretty simple, but setting up the video system seems to cause a good deal of angst and uncertainty. Your camera and video transmitter will arrive with a bewildering variety of wires and leads but typically little information for how to put it together. Not to worry! With a suitable power distribution board, you'll need almost none of it because the power distribution board will take care of everything. Ready to start?



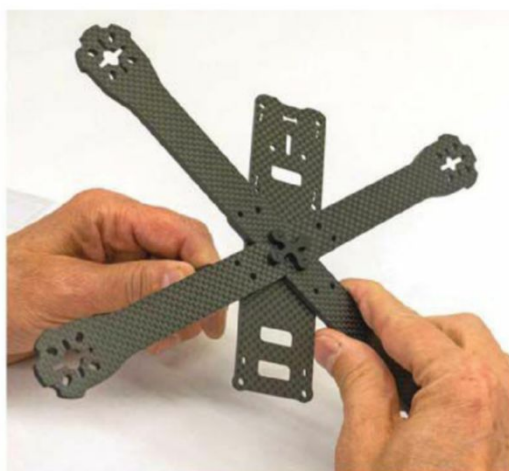
This build worked out really well. For maximum performance, I've changed to DAL 3-blade props. These have more "bite" for quicker acceleration and response, but they're easier to break in a cartwheel. They also pull more current, so flight duration is a little shorter.



1 For this build, I chose the popular Lumenier QAV-R frame, 2204-class motors from HobbyKing, a RunCam Skyplus camera, and a Lumenier TX5GA variable-power video transmitter. Most parts shown here were sourced from getfpv.com.

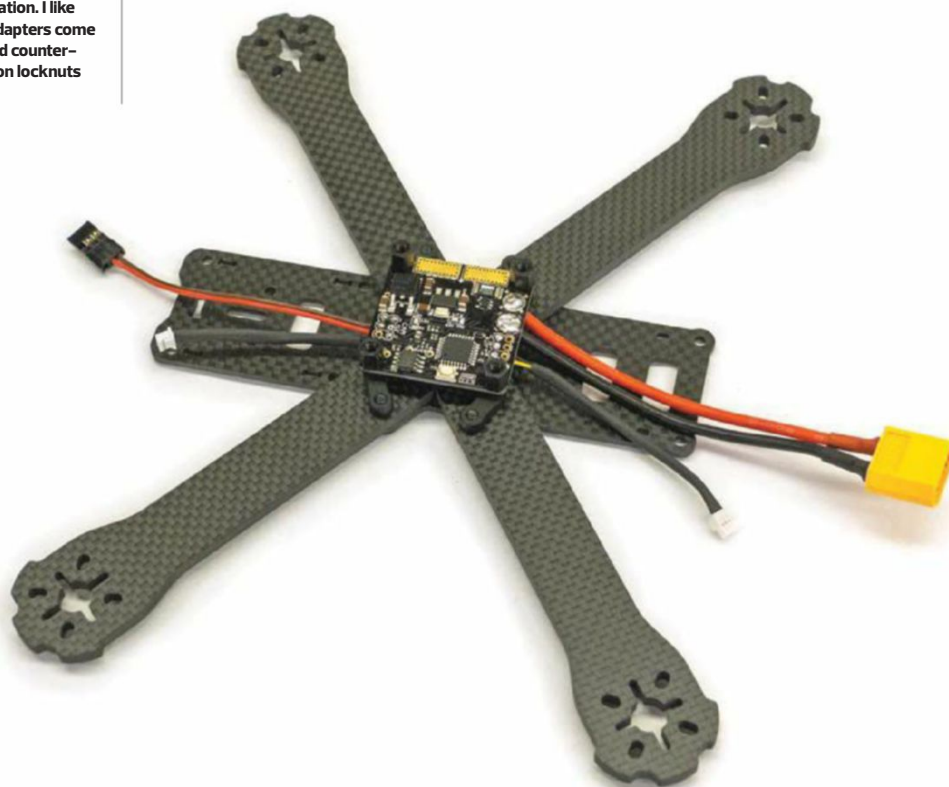


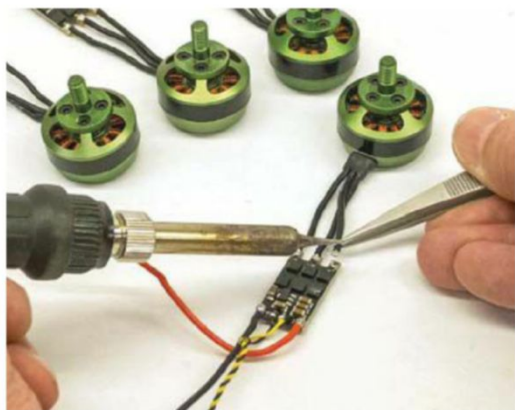
2 I start each build by prepping the motors for installation. I like these Multistar 2204 motors because their prop adapters come with left- and right-hand threads for clockwise and counter-clockwise rotation. I think this is better than depending on locknuts to keep the props from unscrewing.



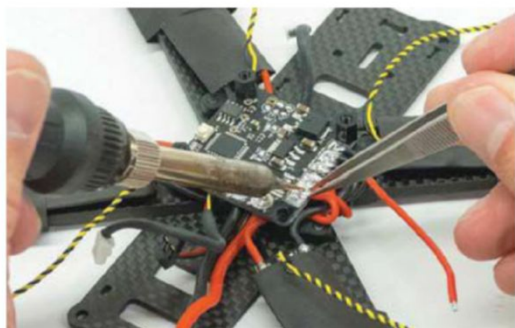
3 The QAV-R frame is stout enough to shrug off some impressive crashes. The 4mm-thick carbon arms are attached to the baseplate with a cluster of M3 screws, and the assembly is amazingly stiff. I recommend using thread-lock, like Loctite 242, on all metal-to-metal screws; just enough to wet the first couple of threads is plenty.

4 The power distribution board is the heart of every FPV racer. This well-tested RedRotor OSD not only supplies power to the speed controls, flight controller, and video gear but also routes the video signal and provides an on-screen display of voltage, flight time, current, and power consumed. Here, I've prepped the board by installing the main power wires and leads for the flight controller, camera, and video transmitter. The video leads were cut from the wire harnesses that came with the camera and video transmitter.

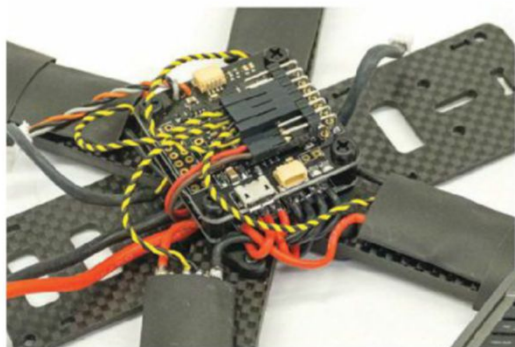




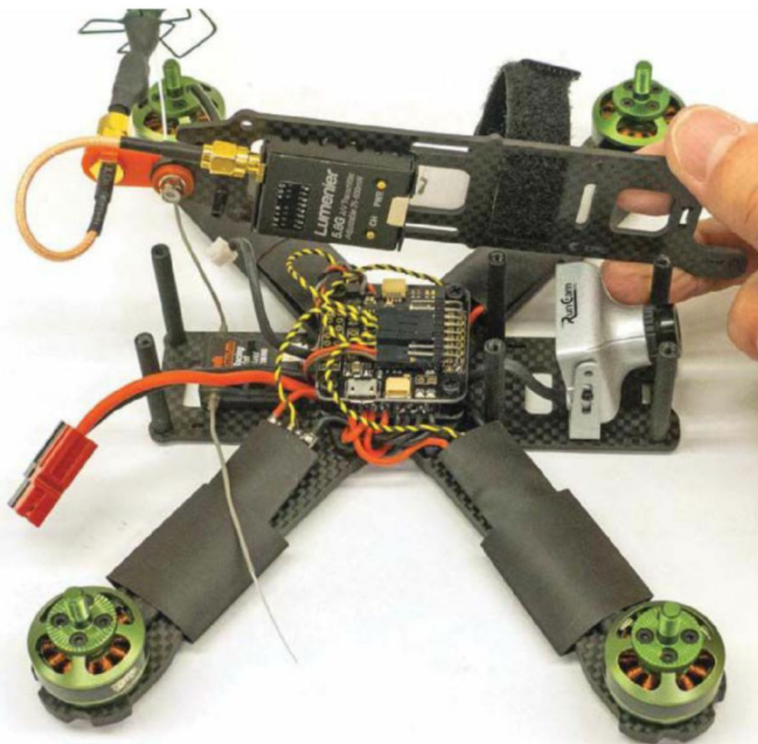
5 I used DYS 20-amp speed controls with the popular BLHeli firmware. I chose to hard-wire the motor leads directly to the boards, but these controllers come with installed leads if you'd prefer to splice the wires instead. Note that the motors with left-hand threads have straight connections for clockwise rotation, while the motors with right-hand threads have two leads crossed to spin counterclockwise. Your speed controls may be different, so test them before you solder them all together.



6 Mount the motors on the arms before soldering the speed-control leads to the output pads on the power distribution board. That way, you can trim the speed-control leads to the correct length. Note that I've slipped pieces of shrink tubing over the speed controls and motor arms, but I'll wait until after the first test hop before I shrink the tubing, just in case I need to change anything. Some fliers use electrical tape for securing the speed controls, but I like shrink tubing because it's tougher and looks better.



7 If the power distribution board is the heart of the racer, the flight controller is the brain, and it stacks directly on top of the board. It's a good idea to soft-mount the flight controller with O-rings or grommets. Here, I'm using a Tornado flight controller from MotoLab. Some builders like to hard-wire the speed-control signal leads directly to the flight controller, but I prefer to install right-angle header pins and crimp two-pin connectors on the speed-control leads. A big thank-you to my flying buddy John Kauk for his great idea of pointing the header pins rearward across the flight controller. This is more compact and keeps the connectors better protected.



8 The last major assembly step is installing the video gear and the top plate. I've installed the RunCam video camera and the Spektrum satellite receiver on the baseplate, and I've installed the Lumenier video transmitter on the underside of the top plate where it'll be out of the way. It's easier to thread the Velcro battery strap before installing the top plate. Note that the video antenna is already installed; if you power up the video transmitter without an antenna, you'll fry it in seconds!



PRO TIP A bright, shiny soldering tip is crucial to achieve quality results. Wipe the tip frequently, and when needed, use a soldering tip cleaning/tinning product, like Weller 0051303199. This clean s away accumulated oxides and tins the tip much better than a simple coat of solder.



9 With the assembly completed, it's time to program the flight controller. The Tornado is compatible with Betaflight, a Google Chrome applet based on the earlier Cleanflight. You walk through the setup steps on your laptop computer and then flash the settings to the flight controller. On my build, I had to increase the low-end throttle travel on my transmitter to get the speed controls to arm, but that was the only issue I had.

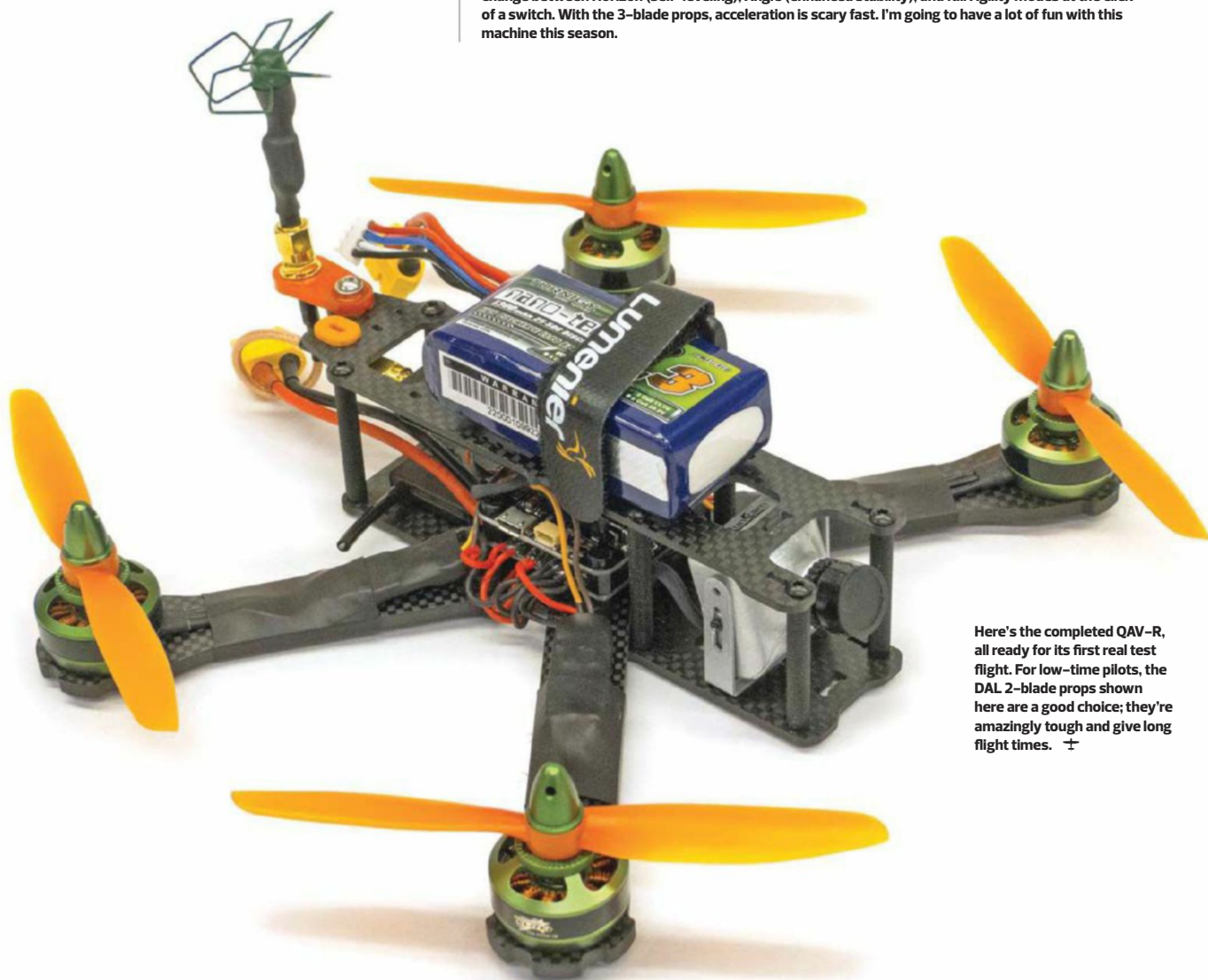




10 Other than breaking inexpensive props, the most common damage in a crash is the delicate video antenna. Trueblood Engineering (truebloodengineering.com) produces this nifty flex mount that lets the antenna bend out of harm's way. It's available in a range of colors, has two mounting options, and costs a whole lot less than a new antenna.



I'm impressed with the handling provided by the Tornado flight controller. I have it programmed to change between Horizon (self-leveling), Angle (enhanced stability), and full Agility modes at the click of a switch. With the 3-blade props, acceleration is scary fast. I'm going to have a lot of fun with this machine this season.

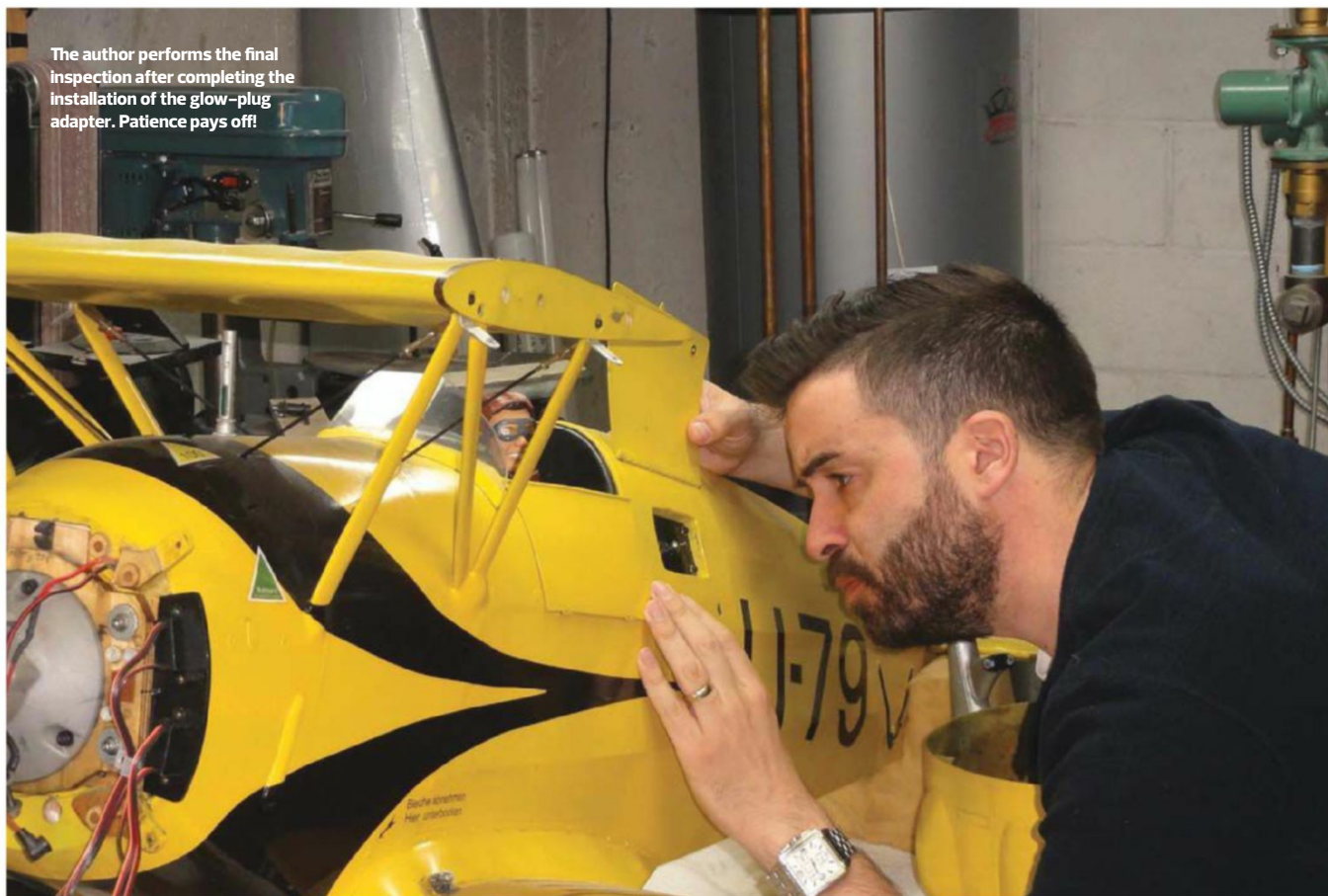


Here's the completed QAV-R, all ready for its first real test flight. For low-time pilots, the DAL 2-blade props shown here are a good choice; they're amazingly tough and give long flight times. ±

LET'S TALK GIANT SCALE

BY JOHN GLEZELLIS

The author performs the final inspection after completing the installation of the glow-plug adapter. Patience pays off!



Pick Your Power

Many options exist for the giant-scale enthusiast regarding engine selection. You can use a large glow engine, a gas engine with a magneto, or an electronic ignition. Semi-scale models typically have some of the engine exposed, and this makes cooling and access to the carburetor easier. But if your objective is to have a fully concealed installation, a few challenges may result.

ENGINE SELECTION

You should begin by examining your model and the space available for both your engine and exhaust system. Thought needs to go into the mounting method for the engine and the location of certain components, like the carburetor, to see if the engine will fit in the aircraft. When space is limited, select a single-cylinder or an inline twin engine. If simplicity is desired, select a larger glow-powered engine to eliminate the added weight of the ignition.

For those who prefer gas, a magneto engine coupled with a spring starter is a simple installation, and it's very easy to operate. Gasoline engines that feature electronic ignitions are also very popular and come

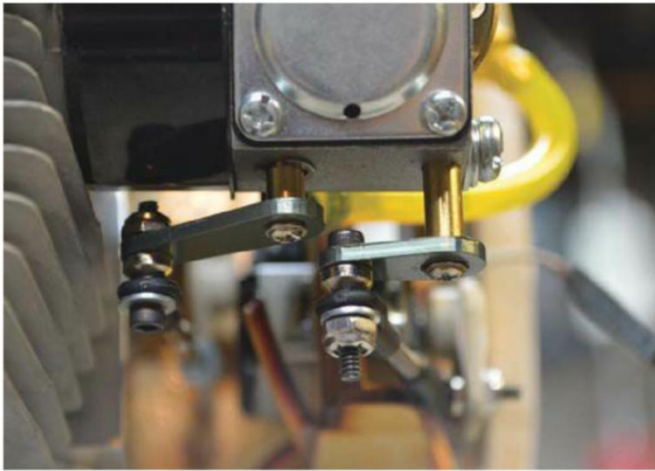
in a variety of displacements. They tend to obtain lower idles at a lower overall weight compared to a magneto engine. While most builders consider displacement, sound, physical dimensions, and cost, it is also important to consider familiarity. In other words, select an option that you are familiar with, and if it is something new, seek the advice of an experienced builder.

With exhaust systems, one should never feel limited to the commercially available exhaust options that exist. Modifications will often be required to use a muffler. In the most basic form, extensions for the exhaust stacks might be required to route the exhaust in a similar manner to the full-scale subject. Companies like JTEC Radiowave can also be used for custom

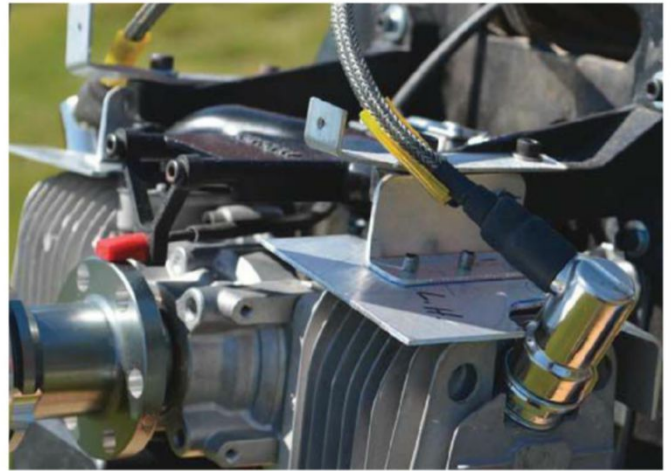
muffler services. Explore all options before making a dreaded and unwanted modification to your bird's cowl.

PROPER SETUP

Assuming the engine and all related items are installed on the aircraft, you should configure the throttle linkage so that there is a linear response between the throttle stick and the throttle butterfly or carburetor barrel. The position of the throttle butterfly or barrel should correspond to the exact position of the throttle stick. This will require that the endpoint adjustments (also known as the adjustable travel volume settings) for both the high and low settings are similar and at a value above 100% for the best possible servo resolution. I recommend that you maximize the high and low percentages and then adjust the linkage geometry to allow for proper movement. In a poorly programmed model, you may notice that maximum throttle movement is achieved when the throttle stick is only at the 75% point! Also, if you don't notice binding and that the throttle servo is actually trying to move beyond the point allowed by the carburetor, it can lead to servo failure.



Servos used to operate the choke and throttle arms eliminate the need for you to access the carburetor, resulting in the ability to add scale features to the cowl of the aircraft.



To direct airflow directly to the cylinder(s), make baffles out of wood, fiberglass, or aluminum. Proper cooling techniques are critical—especially on inline twin engines—to ensure that the rear cylinder is at the proper temperature.

With the engine selected and the proper linkage configuration, you can begin the break-in process. Recently, I purchased a 29%-scale Bücker Bü 133 that was scaled down from Gary Allen plans and built by Raymond Schmidt Jr. This is a unique model that features a Moki 210 for power. On a glow engine like the Moki, a

rather large opening would be required in the cowl to allow access to the needle valve. For the Bü 133, I made a small (2mm) opening to access the high-speed needle, which I modified with a socket insert secured to the high-speed needle using JB Weld epoxy. I can now adjust the high-speed valve by simply inserting a socket head

driver into the needle valve.

For the initial setup, I prefer to begin with the high-end needle and idle disc at the factory-recommended settings. Always check the needle adjustments as some engines are shipped with both needles in the closed position. After the engine starts, I generally



To conceal certain areas of the engine, you may need to install the engine at a slight angle while ensuring that the shaft is in the correct position, as it is here on this AT-6.



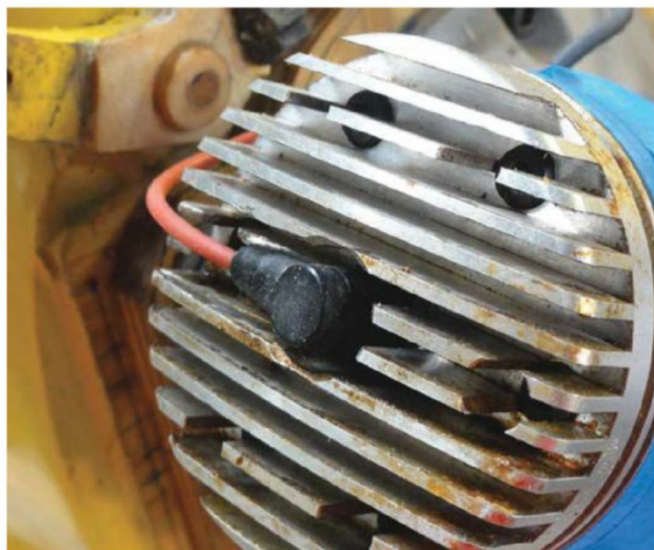
Some models may require a shaft extension or a custom muffler to keep the engine assembly concealed within the cowl, as it is here on this beautiful Composite-ARF P-51 Mustang.



I used a remote glow-plug adapter from Revolution to maintain the scale outline of the cowl and to keep the glow igniter away from the propeller of the aircraft.



This screen in front of the engine allows proper airflow over the engine cylinder. Always observe what was done on the full-scale subject and adapt similar concepts to the model.



I modified the cooling fins on this Moki 210 to allow the Revolution adapter to connect properly to the glow plug.

increase throttle to about 15% and will allow the engine to warm up. Once every minute or two, I increase throttle and adjust the high-end needle to obtain maximum rpm by turning the needle clockwise to "lean out" or counterclockwise to "richen" the engine. When maximum rpm is obtained, I richen the setting until it drops about 500rpm to ensure that the engine will not overheat. It is then important to adjust the idle disc to result in a smooth transition from idle to maximum power. If the engine appears to stutter during the transition, adjust the idle disc in extremely small increments. Turn the disc clockwise to eliminate the poor transition, and turn it counterclockwise

if the engine quits during the transition. Repeat the process until you are satisfied. For safety purposes, please make all engine adjustments after the engine is shut off. Also, settings will differ with the cowl removed, so patience is a virtue during this process.

A carburetor on a gasser, like the Zenoah G-38 or Desert Aircraft DA-170, is quite similar to the Moki with respect to the adjustment procedure. These engines, however, feature a carburetor that has a high- and a low-speed needle instead of the high-end needle and idle disc. You can access the high- and low-end needles by making two small access holes so that a long, narrow screwdriver can be used

for fine adjustments. These engines feature carburetors that have a high- and a low-end needle marked with an "H" and an "L." Observe the full-scale subject and note any possible access points on the real aircraft that can be disguised for access to the needles.

BASIC COOLING

For consistent performance—no matter what type engine, gas or glow—proper cooling techniques are required; otherwise, the engine can overheat and a loss of power may occur. If an engine runs over a given temperature, which will vary on the engine type, the results can be fatal for an aircraft. For a Desert Aircraft two-

cylinder engine, you can expect a temperature of between 210°F and 240°F immediately after shutdown. Over time, you might note a light pink hue on the cylinder; this is a sign that the engine has overheated multiple times. Before this occurs, consult the manufacturer to find out details on the safe temperature range and use a temperature gun or telemetry to make certain that the temperatures align.

To keep the engine running cool, a few methods exist. For added realism, I installed a dummy resin-cast radial engine on the Bucker. Pushrod tubes, spark-plug wires, and a list of other fine details were added before the entire assembly was painted and secured to the airframe. I removed a cylinder from the dummy engine, however, to allow for proper cooling and airflow over the single-cylinder Moki 210 and also allow access to the carburetor for proper starting procedures.

For models that may have a recessed cylinder within the cowl, you can make air ducts out of thin plywood, fiberglass, or aluminum sheeting. Secured in most cases to the cowl, these ducts can direct air to the cylinder head(s). After all, fresh air must enter and pass over the cylinder to prevent the engine from overheating! Air must also flow through the cylinder fins to properly cool the engine, so you should have an outlet that's approximately 2 1/2 times greater than the intake. Observe any features on the full-scale subject to allow for proper cooling of the engine, and apply them to your scale model.

SAFETY FIRST

Since the Bü 133 features a Moki 210 glow engine, I used a remote glow-plug adapter from Revolution to maintain the scale outline of the cowl. With the adapter, I was able to extend the actual plug interface rearward to an access hatch on the aircraft. The opposite end contains a rubber-insulated glow-plug terminal that aggressively holds onto the plug. I modified the cooling fins to allow the adapter to connect properly to the glow plug. Aside from keeping true to the scale cowl outline, having access to the adapter behind the cockpit allowed for safe starting practices by removing the glow starter and keeping my hands away from the propeller. I created an extension by soldering wire to each end (with the assistance of a magnifier) and inspected all solder joints before applying heat-shrink material. Keep the wires short enough to allow the highest possible voltage to reach the glow plug. If in doubt, you can always use a voltmeter to verify proper voltage to the plug.

If you have difficulty obtaining a reliable idle, you can use an onboard glow-driver system, like the ones from Sonic-Tronics and McDaniel, to improve engine reliability. On this particular unit, for example, which uses an additional 1.2–1.5V battery, two options for control exist.



An adapter has been secured to the high-speed needle using JB Weld epoxy.



A cylinder has been removed on the resin radial engine to allow air to flow over the head of the engine.

You can keep the system in a powered state with the use of a two-position switch on your transmitter; use the system so that whenever the throttle is in a certain range, such as 25% and lower, the system is powered. In addition to promoting safety and keeping the idle consistent, you can start the engine without a glow igniter.

FINAL THOUGHTS

Analyzing your project and selecting a suitable engine for it will help make things run more smoothly. Understanding the importance of proper cooling and setup techniques will also guarantee reliable engine performance. And remember to check out the latest products to help make your installation safe and secure. ✚

Final Approach

BY THE MODEL AIRPLANE NEWS CREW

Rebirth of the Telemaster

A Kickstarter that uses a classic aircraft to turn young adults into entrepreneurs and innovative thinker/makers



A teacher and some students look at dozens of parts that go into assembling a wing of the Telemaster 1450.



Students check a quality-control sheet of what goes into a Telemaster model box that's ready for shipment.

The Telemaster is a classic RC design that thousands of modelers have built and flown for generations. Anyone who learned to fly in the 1960s, '70s, or '80s knows that the Telemaster in its various sizes is a popular, easy-to-build, great-flying airplane. Even today, if you haven't actually flown one, you certainly know someone who has. Originally produced by Alexander Engel of Germany and imported to the United States by Hobby Lobby International in the late '60s, the Telemaster spawned three versions of kits (and even ARFs): the standard 6-foot-span model, the 8-foot-span Senior Telemaster, and the 4-foot-span Junior Telemaster,

making it one of the oldest, continually produced airplane designs available today.

The Telemaster was retained when Mark Cleveland purchased Hobby Lobby and changed its name to Hobby Express. Recently, Mark has been working with Treeline Development to expand the Telemaster heritage and introduce it to a younger generation of makers by forming an approved STEM (Science, Technology, Engineering, and Mathematics) development course. The curriculum is planned to be compatible as a stand-alone class, a work-study job, or an after-school program in which high-school students will learn the basics of quality control and safety while meeting the demands of manufacturing a full-production product. It goes without saying that the program will also encourage student engagement in ideation and entrepreneurial thinking—and RC model aviation!

An excellent win-win situation, this is a great opportunity to train a new generation of makers while greatly expanding the supply of Telemaster kits. While the students learn hands-on in a how-to environment, Treeline also foresees new innovations in product development in the near future, connected with innovative learning for the physics, electronics, and control systems for fixed-wing model aircraft. Competition between programs will also help improve supply-chain development.

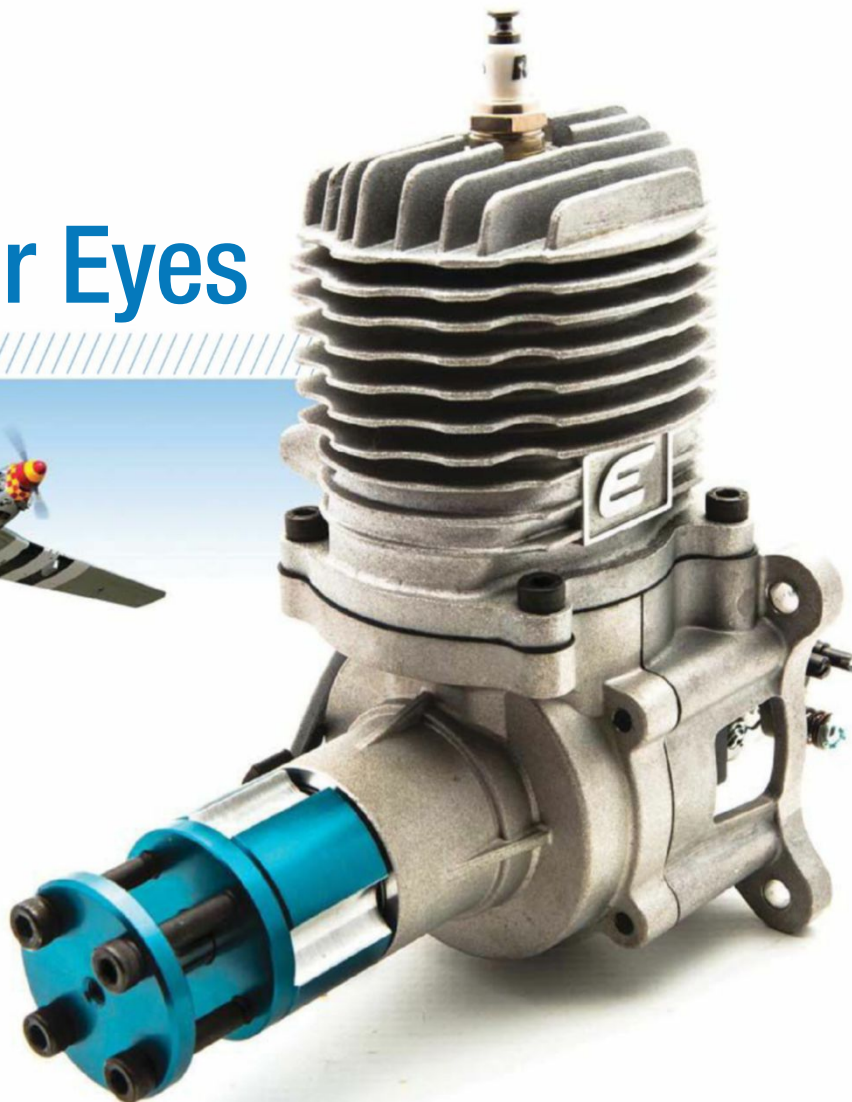
KICKOFF

From May 17 to June 16, 2017, Treeline's crowd-funding campaign will help generate interest and funds for this project. If you'd like to get involved, go to kickstarter.com and search for "Telemaster." Under this new product-development arrangement, Hobby Express will remain the exclusive outlet for Telemaster and all new products Treeline develops for the Telemaster brand. ✈



The students learn what goes into a rigid airframe by assembling a Telemaster 1450 fuselage.

Feast Your Eyes



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- Slender 2S Li-Po-compatible electronic ignition
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Optional muffler shown.



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